

INSTRUCTION BOOK

TAMD60A/B, TAMD70C/D, AQD70C/D

Foreword

Read the instruction book before you attempt starting! The book contains the information you need in order to run and maintain the engine in the best possible way. Do not wait until something has gone wrong before you consult the instruction book to see what you should do.

Volvo Penta has built up an extensive service organization in order to be able to give your engine the service needed. At all major places all over the world there are modern workshops with specially trained personnel at your service. One condition for prompt service is that you always quote the type, designation and serial number of the engine and its equipment.

Volvo Penta dealers and service stations are equipped with the special tools required and they also have extensive stocks of parts so that you are always sure of obtaining genuine parts for servicing and repairing. Always contact your local Volvo Penta representative for service and spares.

A warranty certificate is provided with every engine, giving you information about the protection to which the purchaser is entitled in the event of faults in the product.

The warranty certificate contains cards which should be completed by the dealer or boat salesman and forwarded to Volvo Penta.

If our warranty is to apply, the servicing instructions in the handbook must be followed.

AB VOLVO PENTA

Technical Publications

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Instruction book

Marine diesel engines

TAMD60A, TAMD60B, TAMD70C, TAMD70D, AQD70C, AQD70D

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Safety information

Read this chapter thoroughly. It concerns your safety. This section describes how safety information is presented in this manual and on the product. It also includes a summary of basic safety regulations for boat trips and maintenance of the engine.

Make sure you are in possession of the right instruction manual before reading on. If this is not the case, please get in touch with your Volvo Penta dealer.



Incorrect handling can cause personal injury or damage to the product and/or property. Consequently, please read this instruction manual thoroughly before starting the engine or carrying out maintenance and service. If anything is still not clear or if you are not sure of any points, please get in touch with your Volvo Penta dealer for assistance.

⚠ This symbol is used throughout the instruction manual and on the product to bring your attention to points of safety-related information. Always read such information thoroughly.

Warnings in the instruction manual have the following order of priority:

⚠ WARNING! Warns for the risk of physical injury, severe damage to the product or other property or serious malfunctions that may occur if the instructions are not followed.

⚠ IMPORTANT! Used to call your attention to points that may cause malfunctions or damage to the product or other property.

NOTE! Used to call your attention to important information that can facilitate working methods or handling.



This symbol is used in certain cases on our products to refer to important information found in the instruction manual. Make sure all warning and information symbols on the engine and transmission are easily visible and legible. Replace symbols that have been damaged or painted over.

Safety regulations for boat trips

The new boat

Read instruction manuals and other information accompanying the new boat thoroughly. Accustom yourself with handling the engine, controls and other equipment in a safe and correct manner.

If this is your first boat or if it is a type you are not used to, we recommend practising manoeuvring the boat in a peaceful environment. Learn the sea-going and manoeuvring characteristics at different speeds and in varying weather and load conditions before casting off on your “real” maiden voyage.

Remember that when operating a boat, you have a legal responsibility to be aware of and follow regulations concerning traffic and safety at sea. Inform yourself of the regulations that apply to you and your waters by getting in touch with the relevant authorities or marine safety organisation.

Attending some kind of boat handling course is a good idea. We recommend getting in touch with a regional boat or marine safety organisation to help you locate a suitable course.

Accidents and other incidents

Sea rescue statistics show that deficient maintenance of boats and engines together with defective safety equipment often causes accidents and other incidents at sea.

Make sure your boat and engine are maintained in accordance with directions in the instruction manuals and that the safety equipment on board is in good working order.

Daily inspection

Make a habit of visually inspecting the engine and engine room before starting (**before starting the engine**) and after stopping (**when the engine has been turned off**). This will help you to quickly detect any fuel, coolant or oil leaks and any other abnormalities that have occurred or are about to occur.

Manoeuvring

Avoid violent and rapid rudder movement and gear shifting. There is a risk of the passengers falling down or falling overboard.

A rotating propeller can cause serious injury. Make sure there is nobody in the water before engaging forward/reverse. Never run close to bathers or in places where you have reason to believe there are people in the water.

Filling fuel

There is a risk of fire and explosion when filling fuel. Smoking is prohibited and the engine must be turned off.

Never overfill the tank. Close the filler cap securely.

Use only fuel recommended in the instruction manual. The incorrect grade of fuel can disturb operation or cause breakdown. This can also lead to the control rod jamming on diesel engines, which will overrev the engine and risk damaging machinery and causing personal injury.

Do not start the engine

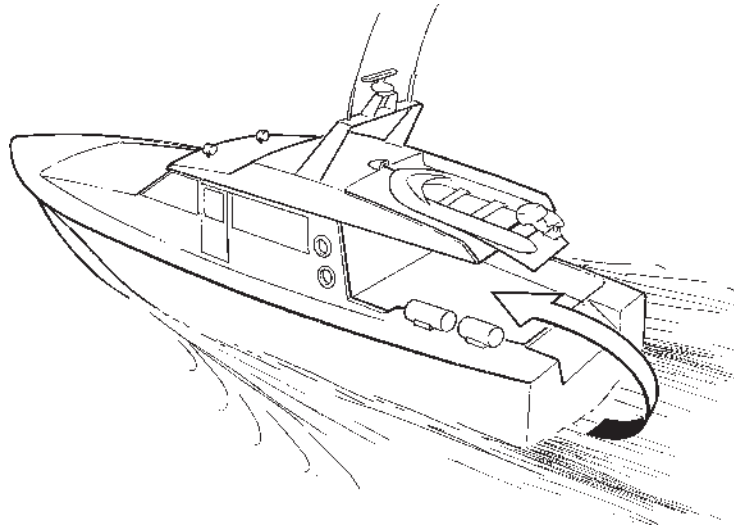
Do not start or run the engine with a suspected fuel or LPG leak in the boat, nor when you are close to or in a discharge of explosive media, etc. There is risk for fire and/or explosion in explosive surroundings.

⚠ Carbon monoxide poisoning

When a boat is moving forward, it will cause a certain vacuum to form behind the boat. In unfortunate circumstances, the suction from this vacuum can be so great that the exhaust gases from the boat are drawn into the cockpit or cabin and cause carbon monoxide poisoning.

This problem is most prevalent on high, wide boats with abrupt stern. In certain conditions, however, this suction can be a problem on other boats, e.g. when running with the cover up. Other factors that can increase the effect of the suction are wind conditions, load distribution, swells, trim, open hatches and portholes, etc.

Most modern boats, however, are designed in such a way that this problem is very rare. If suction should arise anyway, do not open hatches or portholes at the fore of the boat. Surprisingly, this will otherwise increase the suction. Try changing speed, trim or load distribution instead. Try taking down/opening or in any other way changing the setup of the cover as well. Get in touch with your boat dealer for help in obtaining the best solution for your boat.



⚠ Remember

Safety equipment: life jackets for everyone on board, communication equipment, distress rockets, approved fire extinguisher, bandages, life buoy, anchor, paddle, torch, etc.

- Spare parts and tools: Impeller, fuel filter, fuses, adhesive tape, hose clips, engine oil, propeller and tools for tasks it may be necessary to perform.
- Plan your desired route from the charts. Calculate distance and fuel consumption. Listen to weather reports.
- Inform relations of your planned route for long trips. Remember to inform of changed plans or delays.
- Inform the people on board of where the safety equipment is located and how it works. Make sure there is more than one person on board that knows how to start and manoeuvre the boat safely.

This list should be supplemented with necessary safety equipment depending on the type of boat, where and how it is being used, etc. We recommend you get in touch with a regional boat or marine safety organisation to obtain more detailed marine safety information.

Safety directions for maintenance and service

Preparations

Knowledge

The instruction manual contains directions for performing normal maintenance and service in a safe and correct manner. Read the directions carefully before starting work.

More detailed service literature is available from your Volvo Penta dealer.

Never perform a task unless you are absolutely sure how it is to be carried out, call your Volvo Penta dealer for assistance instead.

Stop the engine

Stop the engine before opening or dismantling the engine hatch/hood. Maintenance and service must be carried out with the engine stationary unless stated otherwise in the instructions.

Prevent inadvertent start of the engine by removing the starter key and turning off the power with the main switch, locking it in the off position. Place a warning sign in the driver position stating that service is in progress.

Working on or approaching a running engine is a safety hazard. Loose clothing, hair, fingers or a dropped tool can fasten in rotating parts and cause serious bodily injury. Volvo Penta recommend leaving all work requiring the engine to be running to an authorised Volvo Penta service centre.

Lifting the engine

Always use the lifting eyes mounted on the engine (or reverse gear) when lifting the engine. Always make sure lifting equipment is in good condition and constructed for the lift (engine weight together with possible reverse gear and extra equipment). Use an adjustable lifting boom to ensure safe handling when lifting the engine. All chains and wires must run parallel with each other and as much at right-angle as possible to the top of the engine. Note that any extra equipment mounted on the engine can change the centre of gravity. Special lifting devices may be required to obtain the right balance and safe handling. Never perform service on an engine suspended only from a lifting device.

Before starting

Refit all guards and covers that have been removed before starting the engine. Make sure there are no tools or other objects left on the engine.

A turbocharged engine must never be started without the air filter fitted. The rotating compressor wheel in the turbocharger can cause severe personal injury. There is also a risk of foreign objects being drawn in and causing mechanical damage.

Fire and explosion

Fuel and lubricants

All fuel, most lubricants and many chemicals are flammable substances. Always read and follow the directions on the packaging.

Work performed on the fuel system must be done on a cold engine. Fuel leaks and spills on hot surfaces or electrical components can cause fires.

Keep oil- and fuel-drenched rags and other hazardous materials where they are safe in case of fire. Oil drenched rags can self-ignite in certain conditions.

Never smoke when refuelling, topping up with oil or when in the vicinity of the fuel station or engine room.

Non-original parts

Components in fuel, ignition and electrical systems on Volvo Penta engines are designed and manufactured to minimize the risk of explosion and fire in compliance with existing legislation.

The use of non-original parts can result in explosion or fire.

Batteries

Batteries contain and generate oxyhydrogen gas, especially when charging. Oxyhydrogen is easily ignited and extremely explosive.

Smoking, naked flames and sparks must never occur in or close to the batteries or battery compartment.

A faulty battery connection or jumper cable can generate sparks which can cause the battery to explode.

Start spray

Never use start spray or similar start help. Explosions can occur in the intake manifold. Risk for personal injury.

Hot surfaces and fluids

A hot engine always involves risk for burn injuries. Take care with hot surfaces. E.g.: exhaust manifold, turbocharger, oil pan, charge air pipe, starting heater, hot coolant and warm lubricant in pipes and hoses.

Carbon monoxide poisoning

Start the engine in well ventilated spaces only. When running in confined spaces, the exhaust gases and crankcase gases must be evacuated.

Chemicals

Most chemicals such as glycol, anti-corrosion agent, preservatives, degreasing agent, etc., are hazardous to health. Always read and follow the directions on the packaging.

Certain chemicals such as preservatives are flammable and harmful to inhale. Provide good ventilation and use breathing protection when spraying. Always read and follow the directions on the packaging.

Store chemicals and other hazardous materials out of reach of children. Leave left over or used chemicals to a destruction plant.

Cooling system

There is a risk of water entering when working on the seawater system. Therefore, stop the engine and close the sea cock before starting work.

Avoid opening the coolant filler cap when the engine is warm. Steam or hot coolant may spurt out and cause burn injuries.

If the filler cap, coolant pipe, cock, etc., must nevertheless be opened or dismantled while the engine is warm, the filler cap must be opened carefully to release the pressure before removing it completely and starting work. Note that the coolant can still be hot and cause burn injuries.

Lubricating system

Hot oil can cause burn injuries. Avoid skin contact with warm oil. Make sure the lubricating system is depressurised before starting work. Never start or run the engine with the oil filler cap removed or there will be a risk of the oil being thrown out.

Fuel system

Always protect your hands when carrying out leak detection. Escaping fluids under pressure can pierce bodily tissue and cause serious injury. Risk of blood poisoning.

Always cover the generator if it is located under the fuel filter. Fuel spills can damage the generator.

Electrical system

Turn off the power

Before starting work on the electrical system, the engine must be stopped and the power turned off with the main switch/switches. Shore power to the engine heater, battery charger or other extra equipment fitted to the engine must be disconnected.

Batteries

Batteries contain a highly corrosive electrolyte. Protect your eyes, skin and clothing when charging and handling batteries. Always use protective goggles and gloves.

In case of splashes on the skin, wash with soap and plenty of water. In case of splashes in the eyes, rinse immediately with plenty of water and call a doctor.

Presentation

The engines described in this instruction book are six-cylinder, in-line marine diesel engines with direct fuel injection and fresh water cooling and equipped with a turbo-compressor and after-cooler for the intake air.

Type designations

Aquamatic engines	Inboard engines	Locating of number plate	
AQD70C AQD70D	TAMD60A TAMD60B TAMD70C TAMD70D	Engine: On the block above the injection pump. TAMD60: On the block in front of the oil filters.	Reverse gear: On top of the reverse gear housing. Drive 750: On the upper gear housing, port side.

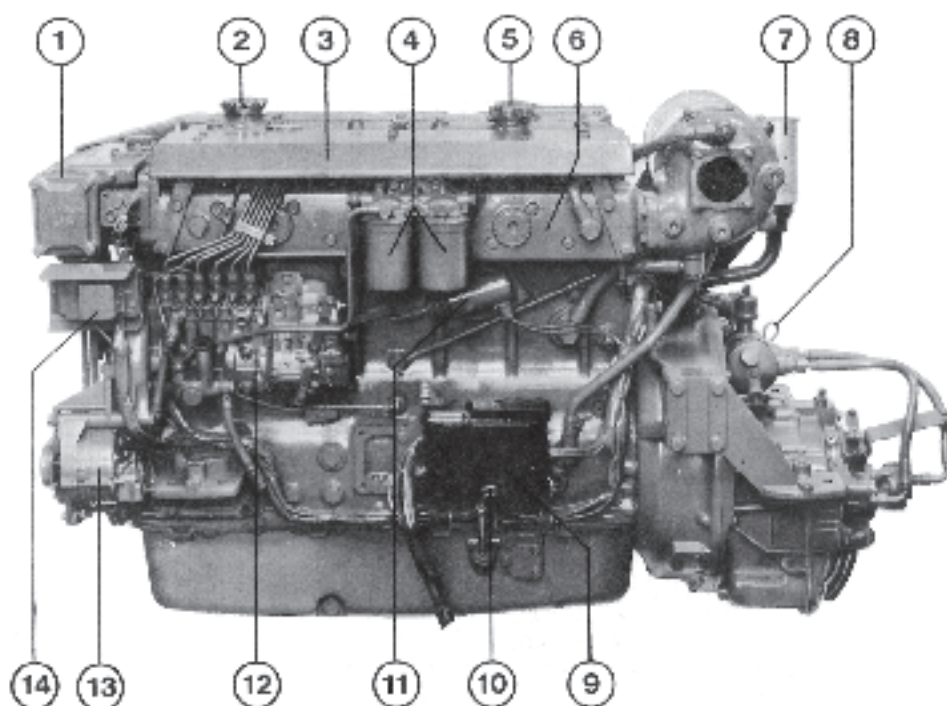


Fig. 1 Engine TAMD60B

1. Heat-exchanger
2. Coolant filler cap
3. Protecting plate
4. Fuel fine filters
5. Engine oil filler cap
6. Liquid cooled exhaust manifold
7. Filter, crankcase ventilation
8. Oil dipstick, reverse gear
9. Electric connection box with fuses
10. Oil dipstick, engine
11. Stop solenoid
12. Injection pump
13. Alternator
14. Charging regulator

Fig. 2. Engine TAMD60A

1. Turbo-compressor
2. Air cleaner
3. After-cooler
4. Expansion tank (cooling system)
5. Oil cooler for engine
6. Connection for expansion vessel (extra equipment)
7. Seawater pump
8. Lubricating oil filters
9. Starter motor
10. Outlet, crankcase ventilation
11. Reverse gear TD MG502
12. Oil cooler for reverse gear

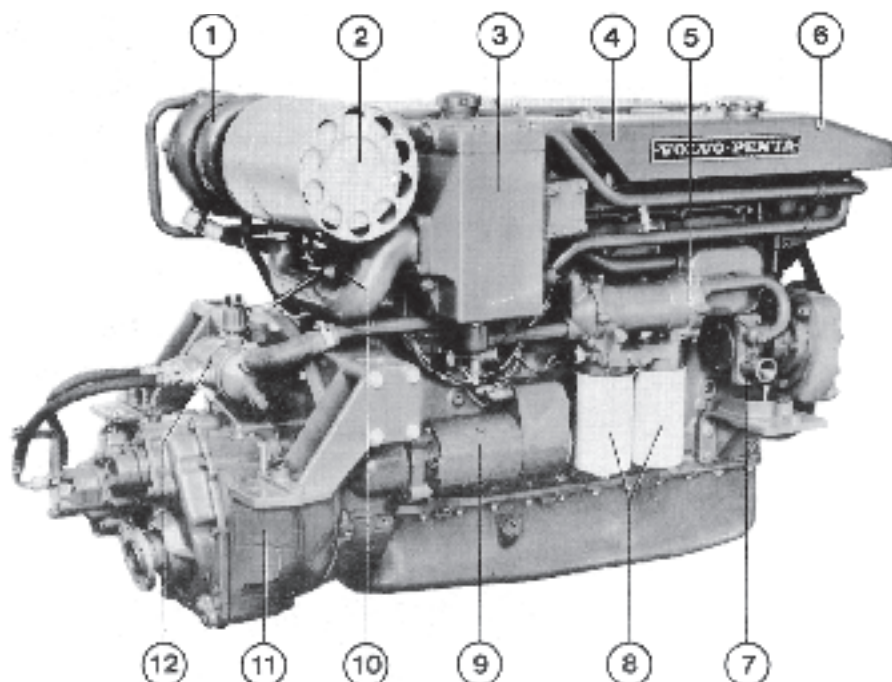
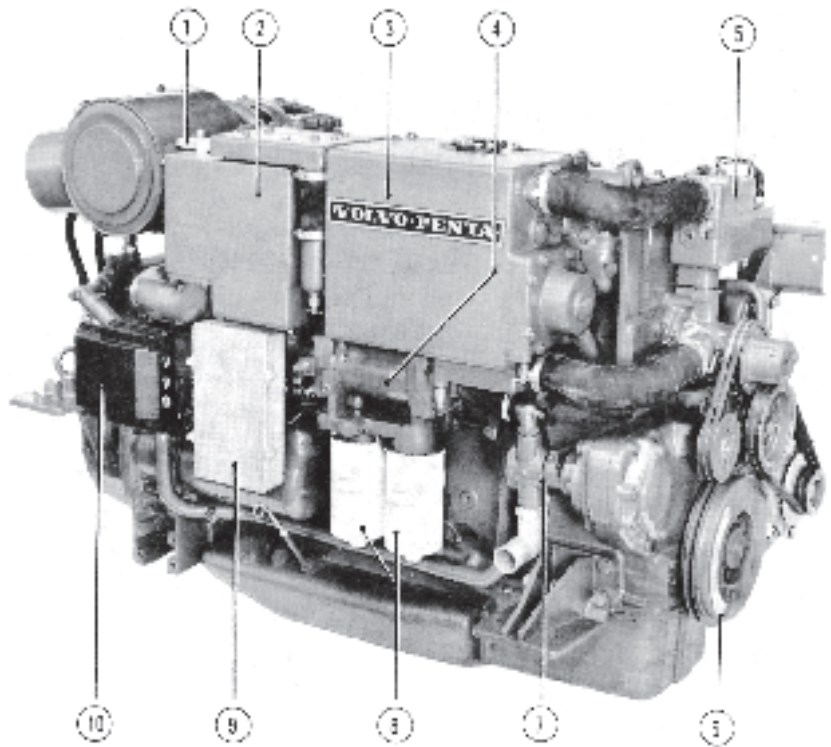


Fig 3. Engine AQD70C, TAMD70C

1. Oil scavenging pump
2. After-cooler
3. Heat exchanger
4. Oil cooler, engine
5. Thermostat housing
6. Vibration damper
7. Seawater pump
8. Oil filters
9. Relay box
10. Electric connection box with fuses



The engines are fitted with a heat exchanger for thermostatically controlled **fresh water cooling** of the engine block, cylinder heads and exhaust manifold. The exhaust manifold cooling jacket is designed so that it also cools all the exhaust ports.

The engines are lubricated by means of a **pressure lubricating system**, where an oil pump supplies lubricating oil to all the lubricating points in the correct quantities at all engine speeds. **The pistons in the 70-type engines are**

cooled by oil fed through special nozzles located in the engine block.

The lower part of the crankcase functions as an oil container.

The fuel system is well protected from interruptions during running by means of effective, replaceable fuel fine filters. On the TAMD60 engines the fuel injection pump is flange mounted while the other engines have the pump fitted on a bracket.

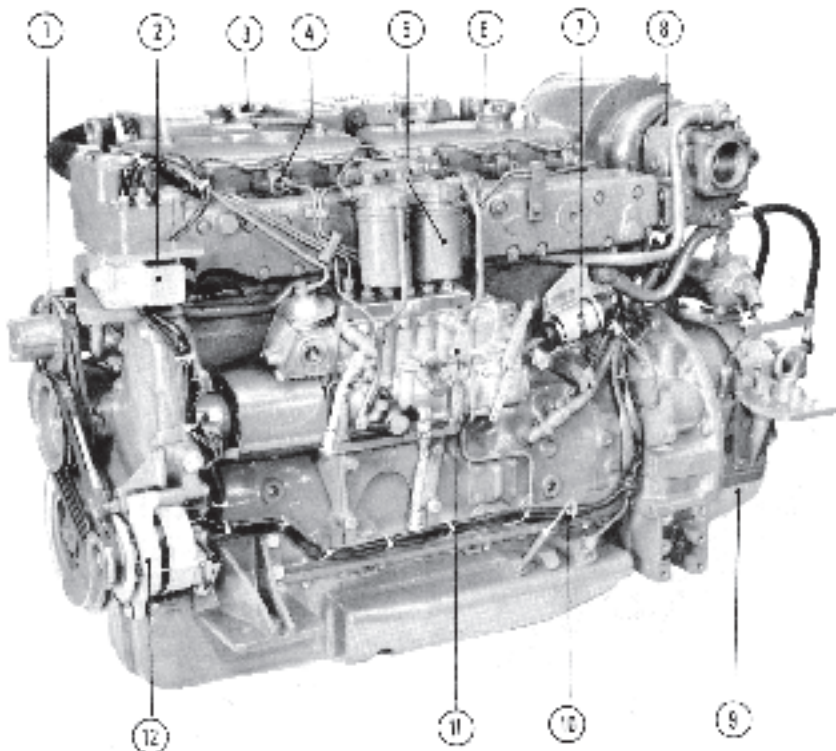


Fig. 4. Engine AQD70C, TAMD70C

1. Circulation pump
2. Charging regulator
3. Coolant filler cap
4. Injector
5. Fine filters
6. Oil filler cap
7. Stop solenoid
8. Turbo-compressor
9. Reverse gear TDMG506
10. Oil dipstick
11. Fuel injection pump
12. Alternator

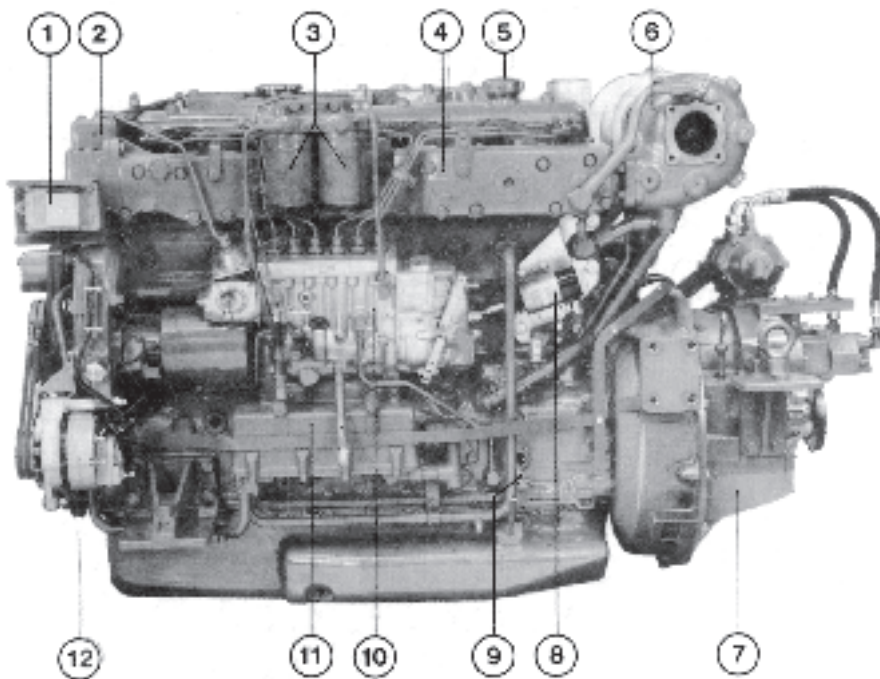


Fig. 5. Engine TAMD70D

1. Voltage regulator
2. Thermostat housing
3. Fuel fine filters
4. Water-cooled exhaust manifold
5. Oil filler cap
6. Turbo-compressor
7. Reverse gear TD MG506
8. Stop solenoid
9. Oil dipstick
10. Fuel injection pump
11. Oil cooler
12. Alternator

The engines have **wet replaceable cylinder liners** which are cooled by fresh water.

The **turbo-compressor** supplies fresh air to the engine during the induction stroke. Air is supplied under pressure, resulting in a greater degree of volumetric efficiency. The cylinders thus receive a greater quantity of air and consequently more oxygen per stroke. In consequence the amount of fuel injected can also be increased, which leads to increased output.

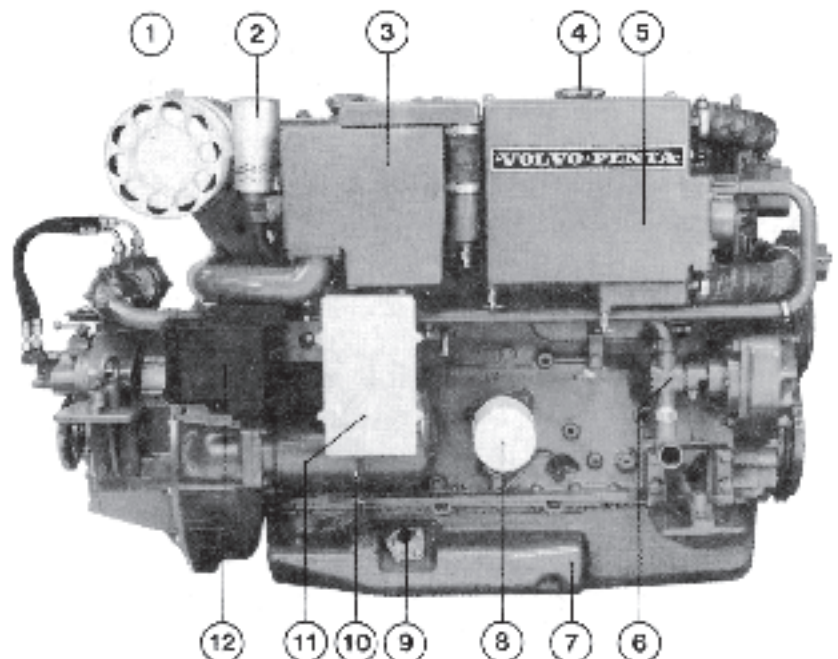
The turbo-compressor is lubricated from the engine lubricating system and cooled from the fresh water cooling system.

In order to further increase the supply of oxygen, the air to the engine is cooled down by an **after-cooler** located after the compressor at the intake manifold.

The Aquamatic models are provided with a hydraulic pump and a special connection flange at the reverse gear. Otherwise they are similar to the inboard engines. The hydraulic pump, fitted at the rear side of the engine auxiliary drive gear casing, close to the fuel injection pump coupling, supplies oil under pressure to the power cylinder acting on the lower, steerable part of the outboard drive. This results in easy and effortless steering of the boat.

Fig. 6. Engine TAMD70D

1. Air cleaner
2. Crankcase ventilation filter
3. After-cooler
4. Coolant filler cap
5. Heat exchanger
6. Seawater pump
7. Oil sump
8. Oil filter
9. Level indicator, lubricating oil (extra equipment)
10. Oil dipstick (alternative location)
11. Relay box for air pre-heater
12. Electric connection box with fuses



Instruments and controls

Before starting to run your new marine engine, become acquainted with the controls and instruments. Make a habit of checking the instruments now and again while running - any abnormal readings will then be detected in time.

Instruments

The most important instruments for the engine are grouped on a basic panel (A). There is a second panel (B) with, among other things, an hour meter, warning lamps, warning siren and pressure gauges for the reverse gear oil pressure and the turbo-charging pressure.

There is also a third panel (C) where a rudder indicator and fuel gauge are fitted. (Panels B and C are optional equipment).

The location of the panels in relation to each other can be varied, since they are built to a modular system.

A separate panel with less instruments is available for the **Flying Bridge** (optional equipment). See fig. 8.

The instrument panels for TAMD60 engines are not fitted with the control lamps 2 and 7 (Fig. 7), since these engines do not have air pre-heating. Otherwise the equipment is the same as for the 70-engines.

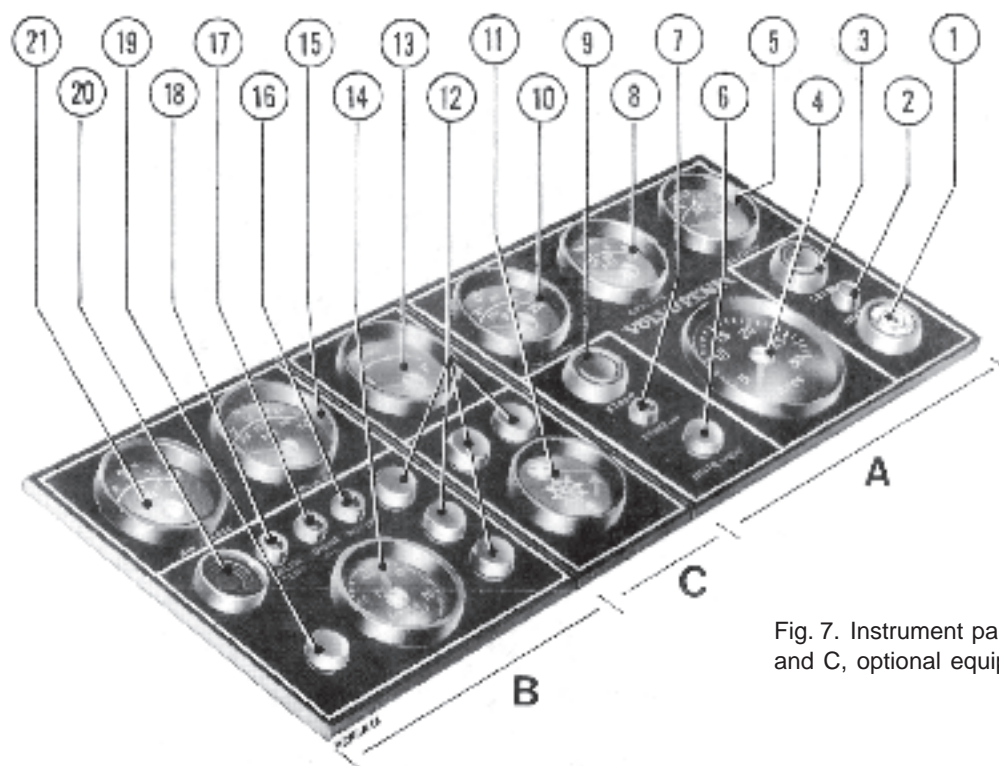


Fig. 7. Instrument panel (Panels B and C, optional equipment)

1. **Key switch** with 4 positions.
Position 0 – the key can be inserted and removed
Position 1 – is not used, turn key past this position
Position II – running position
Position S – pre-heater engaged. Does not apply to TAMD60.
(See also fig. 19)
2. **Control lamp** - (does not apply to TAMD60). This lights up when the air pre-heater is engaged (key turned to position S). It remains alight while the air pre-heater is engaged (approx. 120 sec). The pre-heater disengages automatically.
3. **Stop button** - pushing it engages the stop solenoid causing the engine to stop.
4. **Revolution counter, engine speed** - multiply the figures on the scale by 100.
5. **Voltmeter, charging** of batteries and system voltage. With a 24 volt system, the gauge needle (during running) should be pointing to approx. 28 volts, but for a 12-volt system it should be approx. 14 volts. Should the voltage during running drop to 24 (or 12) volts, the batteries are not being charged.
The meter is wired via the master switch and indicates 24 (or 12) volts with the engine switched off.
6. **Instrument lighting** - indirect lighting of all instruments. Turn the button to vary lighting strength.
7. **Control lamp** - (does not apply to TAMD60) - lights when air pre-heater has been engaged long enough for the engine to be started. The lamp lights about 60 seconds after the key has been switched to position S and remains alight for about 60 seconds, that is, until the pre-heater disengages automatically.

8. **Pressure gauge - engine lubricating oil pressure**, should be at 300-500 kPa (3-5 kp/cm² = 43-71 psi) during normal operation. At idling speed it should be min. 150 kPa (1.5 kp/cm² = 21 psi). The engine must not be run with excessively low oil pressure.
9. **Starter button** - pushing it engages the starter motor.
10. **Temperature gauge engine coolant** - During normal operation the temperature should be between 65° and 95°C (149-203°F). The engine must not be run for more than a few seconds if the temperature is excessive.
11. **Rudder indicator** - indicates the position of the rudder. The middle position of the needle indicates the rudder in neutral.
12. **Push - pull switches** - for extra lighting. (Max. load 5A per switch).
13. **Fuel gauge** - indicates how much fuel there is in the tank. F means full tank, E empty tank, but a small amount of spare fuel (R) however, still remains.
14. **Hour meter** - registers the number of hours and minutes the engine has been running.
15. **Pressure gauge** - reverse gear oil pressure. The pressure should be around the values given in "Technical Data", pages 40 and 41.
16. **Battery charging warning lamp** - lights if the batteries discharge.
17. **Warning lamp** - lights if the engine lubricating oil pressure is too low.
18. **Warning lamp** - lights if the engine temperature becomes excessive.
19. **Push-pull switch** - for extra lighting (max. load 5A)
20. **Siren** - engages automatically if the engine temperature becomes excessive or its oil pressure too low. Either lamp 17 or 18 will light and indicate the type of fault which has arisen.
21. **Pressure gauge** - for the turbo-compressor charging pressure. Concerning the pressure, see "Technical Data", page 40.

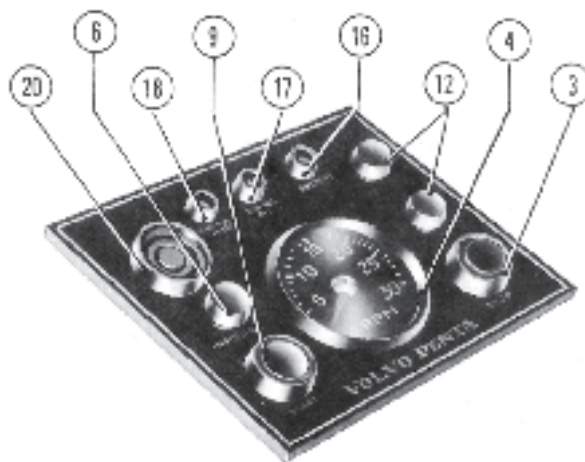


Fig. 8. Flying Bridge instrument panel, optional equipment.

The numbering on figs. 7 and 8 is similar. Flying Bridge instruments which have the same function as those on the basic panel have been given the same numbers.

The engine can be stopped and (if it is warm) started from the Flying Bridge. On such occasions, the key on the lower instrument panel should be switched to the running position.

When the engine is cold, it should always be started from the lower control position and the air pre-heater (does not apply to the TAMD60 engines) should be engaged before starting.

3. **Stop button** – pushing it in engages the stop solenoid and the engine stops,
4. **Revolution counter, engine speed** – multiply the value by 100.
6. **Instrument lighting** – indirect lighting of instruments with switch pulled out.
9. **Start button** – pushing it in engages the starter motor.
12. **Push-pull switches** – for extra lighting (max. load 5A per switch).
16. **Battery charging warning lamp** – lights up if the batteries discharge.
17. **Warning lamp** – lights if the engine lubricating oil pressure is too low.
18. **Warning lamp** – lights if the engine temperature becomes excessive.
20. **Siren** – engages automatically if the engine temperature becomes excessive or its oil pressure too low. Either one of lamps 17 or 18 also lights up and indicates the type of fault which has arisen.

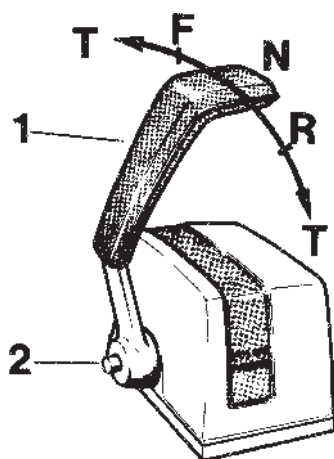


Fig. 9. Single control

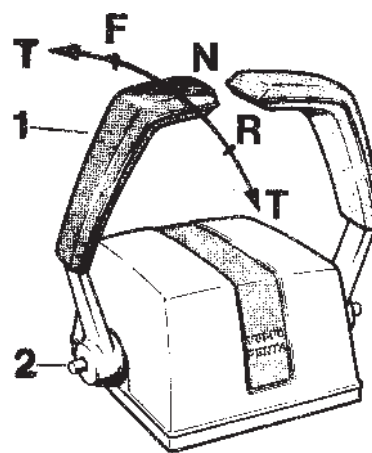


Fig. 10. Twin control

Controls

Volvo Penta single lever control (single or twin), operates both the reverse gear and the engine speed. When there are two engines a twin control is used.

Lever (1) at **N – neutral position**.

From N to F – reverse gear engaged for running forward.

From N to R – reverse gear engaged for running in reverse.

T – engine speed control.

Disengaging reverse gear from control lever.

Push in the button (2) when the lever is in neutral and move the lever forwards. The lever can then be used for controlling engine speed but with reverse gear disengaged. Take care not to engage reverse gear unintentionally.

When it is desired to use the lever again for operating the reverse gear, **keep the button (2) pushed in** and move the lever to neutral again.

As optional equipment, the controls can have a neutral position switch, in which case the engine can only be started with the reverse gear in neutral.

Disengageable clutch

Clutches – with or without reduction gear – have two control lever positions. Engaged – lever pushed towards engine; disengaged – lever pushed away from engine.

When engaging and disengaging the clutches, the engine speed must not exceed 13.3 r/s (800 r/min)

Running

The following instructions apply to engines which have both standard instrumentation and optional instrument equipment. In the case of standard instruments only, the instructions apply where appropriate.

Procedure before starting

1. **Coolant level.** Check that the level is about 5 cm below the expansion tank filler cap sealing surface. There must be an air cushion for the expansion of the fluid. On TAMD60 engines the expansion tank is next to the heat exchanger.

As optional equipment the TAMD60 engines can also be provided with a separately positioned expansion tank which is made of transparent plastic and where the level should lie between the "min." and "max." marks.

NOTE! Remove the cap very carefully if the engine is hot.

When adding coolant, open the venting cocks to make sure that no air pockets form. A ventilating cock is situated on the water pipe at the turbo. For 70-type engines there is also a cock at the front of the thermostat housing.

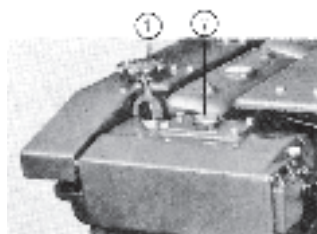


Fig. 11. TAMD60

1. Cap on expansion tank. For topping-up.
2. Hexagon plug on heat exchanger. For filling the system.

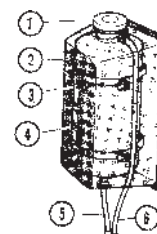


Fig. 12. Separate expansion tank

1. Pressure cap.
2. Cover.
3. Max. level.
4. Min. level.
5. Hose from engine.
6. Hose with open end.

On the **TAMD60 engines**, small quantities required for topping-up can be added to the expansion tank, but otherwise coolant should always be filled directly into the heat exchanger through the hole for the hexagon plug, until the engine is completely full and vented. Then close the venting cock at the turbo and screw the hexagon plug on the heat exchanger. **Thereafter**, fill the expansion tank at the side of the engine (1, fig. 11) with approx. 3 litres (0.66 Imp. galls = 0.80 US galls) and replace the cap.

1. If the engine is connected to a cabin heater, this must also be vented before the cap on the expansion tank or the plug on the heat exchanger are fitted. Otherwise the engine may be damaged due to insufficient cooling.

Finally, fill the separate expansion tank, if fitted, to slightly above the MIN. level.

If the engine should run abnormally hot, carefully vent the cooling system and top up with water.

2. **Lubricating oil level, engine.** Check that the level is between the marks on the dipstick. It must never be permitted to fall below the lower mark.

(Check that the cock under the oil scavenging pump, on the 70C-engine, is closed, see page 24.)

3. **Oil level, reverse gear.** The level should reach the mark (alternatively, it should lie between the two marks) on the dipstick. Repeat the check for Twin Disc reverse gears whilst idling with the control in the neutral position, since this indicates the true level for this type of reverse gear.

The oil level in the Borg Warner and SCG reverse gears should be checked when the engine is not running. The oil level will lie above the "max." mark when the engine has been stationary long enough for the oil to run down from the cooler and passages. To obtain a true level reading the check should be made immediately after the engine has been stopped.

4. Check that the seawater cocks on the engine are closed. See the figures on page 18.
5. Open the bottom valve and the trickle-feed cock to the bilge pump, if fitted. (Fig. 18).
6. **Fuel.** Check that there is sufficient fuel in the tanks and open the fuel cocks.
7. Switch on the master switches. They should be on when the engine is running.
NOTE! Switching off and on must **never be carried out** while the engine is running, since this can damage the charging regulator.

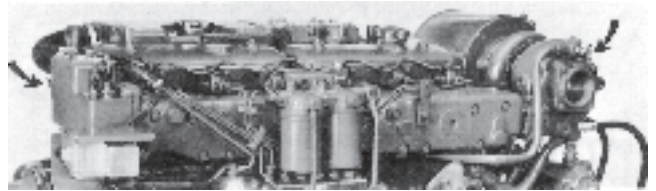


Fig. 13. Vent the cooling system. (The picture shows a 70C engine.)

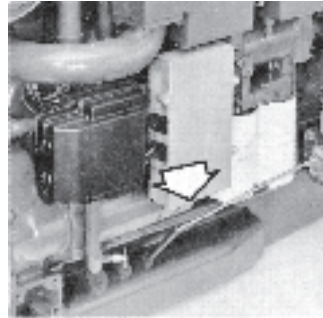


Fig. 14. Oil level, all engines (the picture shows a 70-type engine).



Fig. 15. Check the oil level in reverse gear BW and V-drive BW 10-05.



Fig. 16. Check the oil level in the reverse gear TD.

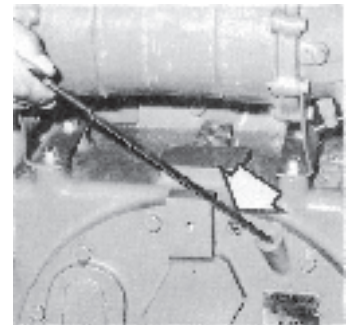


Fig. 17. Check the oil level in reverse gear SCG.

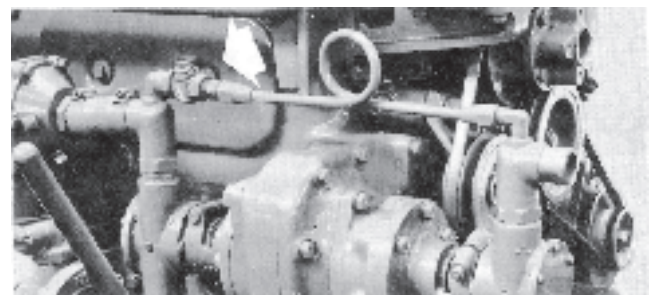


Fig. 18. Cock on trickle-feed line to bilge pump, if fitted. The scribed line should be in line with the pipe when the cock is open.

Starting

With the exception of **TAMD60**, the engines have an air pre-heater fitted in the intake manifold and this should always be used in order to provide a rapid and easy start and to reduce exhaust smoke from a cold engine.

If the engine is warm, the pre-heater does not have to be engaged, in which case the key is turned to position II, running position. Point 2 is excluded and the engine is started regardless of the warning lamps mentioned in point 4.

1. Turn the key to position II and check that the warning lamps 16 and 17, figs. 7 and 8 light. The siren 20 is switched on at the same time. Dampen the noise of the siren by holding your thumb over it.

Always carry out this check before starting, to make sure that warning lights and siren function; in order to be well prepared for an emergency.

2. (This point does not apply to TAMD60 engines.) Turn the key to position S and release it. The key will then return to position II. The warning lamp 2, fig. 7 lights and shows that the pre-heater has been engaged.
3. Set the control (both control levers for twin installation) to neutral. Push in the button (1) so that the reverse gear is disengaged. Keep the button pressed in and then move the lever to full speed "Forward" (2).

4. **On the 70-type engines**, press the starter button 9, fig. 7, immediately when the control lamp 7 lights. (The lamp 7, which lights for about 60 seconds, lights up 60 seconds after the lamp 2.) About 2 minutes after the key has been released from position S, the pre-heater disengages automatically and the lights 2 and 7 go out.

The **TAMD60** engines are not provided with the control lamps mentioned in the point above and are therefore started directly by pushing in button 9.

5. Reduce the speed to approx. 16.7 r/s (1000 r/min) when the engine has started. Check that the warning lamps 16 and 17 go out. The siren should stop when lamp 17 goes out.
6. If a second starting attempt has to be made on engine **TAMD60A**, the control should be moved back to "Neutral" and then re-set to full speed in order to engage the cold-starting device again.

On other engine types, just set the control directly to full speed, at the same time as the pre-heater is re-engaged for the 70-type engines.

7. **Never race a cold engine.** The lubricating oil is viscous in its cold condition and there is always risk of seizing if the engine is raced.

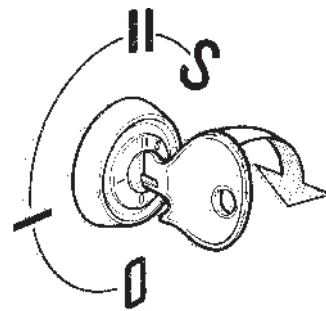


Fig. 19. Position 0, the key can be inserted and removed.
Position 1, not used.
Position II, running position
Position S, pre-heater engaged (not applicable to TAMD60)

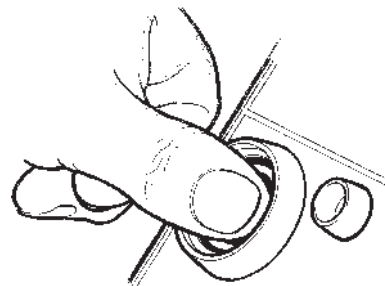


Fig. 20. The sound of the siren can be dampened by placing the thumb over it during the pre-heating period (on the 70-type engines)

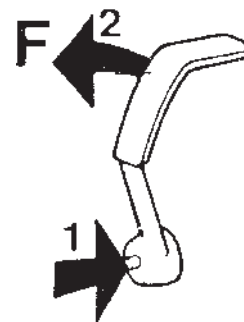


Fig. 21. Disengaging the reverse gear from the control.

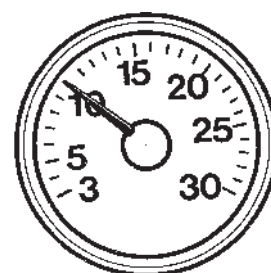


Fig. 22. Engine speed

Procedure after starting

1. Never race a cold engine. Run it warm under light loading or at rapid idling speed.
2. Check that the warning lamp for the oil pressure (17, figs. 7 & 8) goes out immediately after the engine has started. The oil pressure for the engine should be between 300-500 kPa (3-5 kp/cm² = 43-71 p.s.i.) at normal operation. The warning lamp lights and the siren sounds if the pressure drops below 150 kPa (1.5 kp/cm² = 21 p.s.i.), in which case the engine must be stopped immediately in order to avoid engine damage.
3. Check that the charging warning lamp (16) goes out.
4. Keep the button (1, fig. 21) on the control pushed in and pull the control lever to neutral.

Check the oil level in the Twin Disc reverse gear while idling and with the control lever in neutral.

5. Check the engine temperature.
NOTE! The temperature should be between 65–95°C (150°–203°F) during running. If the temperature rises abnormally, open the air cocks on the thermostat housing and the turbo for a few seconds in order to evacuate any air in the coolant system. Top up with water if required.
6. Check the oil pressure for the reverse gear. See "Technical data".

Engine speed

NOTE! Special regulations apply with regard to running-in, see under the heading "Running-in".

Cruising speed is equal to about **3.3 r/s (200 r/min.)** below the maximum speed reached for a given load condition. This results in economical and favourable operation.

Do not run for long periods of time with the engine speed below **23.3 r/s (1400 r/min.)** with the engine under load.

If the speed tends to drop gradually, this may be due to dirt or marine growth on the bottom of the boat. For this reason, the hull below the waterline should always be thoroughly cleaned in such cases and treated with anti-fouling paint before other measures are taken.

Running-in

When the engine is new it should be run with a certain amount of caution during the first **200 hours**. The same applies to a newly reconditioned engine. Read the instruments often and make sure that they give normal readings.

Run at full speed only during short periods for the first 50 hours. During this time, cruising speed should also be reduced so that it is at least **5.0 r/s (300 r/min.)** below the maximum speed attained.

The cruising speed can subsequently be increased gradually, but as a rule, it should be approx. **3.3 r/s (200 r/min.)** below the maximum speed attained.

If a fresh water filter (Perry) is fitted it should be changed for the first time after 150 hours of operation.

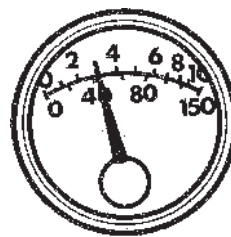


Fig. 23. Engine lubricating oil pressure.

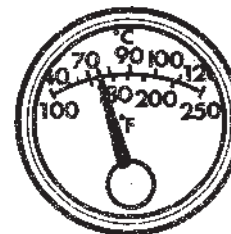


Fig. 24. Engine coolant temperature.

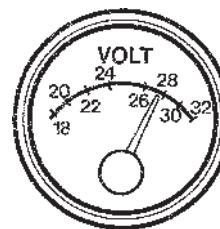


Fig. 25. Charging voltage. The figure shows the 24 V system. Halve the value for a 12 V system.

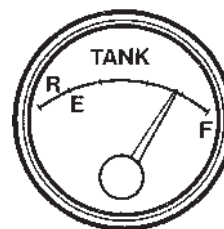


Fig. 26. Fuel gauge. F = Full tank
E = Empty tank R = Reserve fuel.

Subsequently, the filter is normally changed every 600 hours. When removing, the entire filter is unscrewed in the same way as the lubricating oil filters.

Oil changing during running-in

Change the oil in the engine for the first time after running **25 hours**.

Change the oil again after running **100–150 hours** and change the oil filter (filters) at the same time. Never flush out the engine with flushing oil since the bearing pressures in a diesel engine are too high for the use of this kind of oil to be suitable.

The oil in the reverse gear (and the filter element on SCG) should be changed for the first time after **100-150** hours of operation.

The oil is subsequently changed at the normal intervals given in the servicing scheme.

During running

Frequently check during running that all the instruments give normal readings. Some of the instruments are optional equipment, see page 10.

Check	Number in figs. 7 & 8	Observation	Remarks/Actions
Engine lubricating oil pressure	8	300-500 kPa (3-5 kp/cm ² = 43-71 p.s.i.), normally during operation	
Warning lamp (low oil pressure)	17	The lamp should not light. It lights only when the pressure falls below 150 kPa (1.5 kp/cm ² = 21 P.s.i.).	If the lamp lights or if the siren is heard the oil pressure is too low. Stop the engine. Remedy the fault.
Warning siren	20	The siren is heard if the oil pressure falls below 150 kPa (1.5 kp/cm ² = 21 p.s.i.).	
Engine coolant temperature	10	65-95°C (150-203°F) normally during operation.	If the lamp lights and the siren is heard the engine temperature is too high. Stop the engine. Remedy the fault.
Warning lamp (coolant temperature)	18	The light should not come on. (Lights if engine temp. exceeds approx. 95°C = 203°F, the siren is also heard).	
Charging voltage	5	During normal running approx. 28 volts for 24 V system and approx. 14 volts for 12 V system.	If the voltage drops to 24 (or 12) volts during running, the batteries are not being charged. Remedy the fault as soon as possible.
Warning lamp (battery charging)	16	The lamp should not light.	The batteries are not being charged if the lamp lights up. Remedy the fault as soon as possible.
Turbo-charging pressure	21	Normal pressure, see "Technical data". The pressure depends greatly on the output. The engine should run at full load for 2-3 minutes before reading the pressure gauge.	The charging pressure is considerably lower than those values given in "Technical Data", unless full engine output can be developed. Check that the charging pressure does not drop unduly from the normal test pressure reached for the boat in question.
Reverse gear oil pressure	15	The pressure should correspond with the values given in "Technical data", pages 40 and 41.	Slipping can occur if pressure is too low. This can cause damage to the reverse gear.
Fuel quantity in tanks	13		Avoid stoppages for want of fuel. If this should happen, the fuel system must be vented, after filling with fuel.

Stopping

1. **Let the engine run for a few minutes without load** to enable the engine temperature to drop, thereby avoiding after-boiling.
2. Press in the stop button and keep it pressed in until the engine has stopped,
3. Close the cock on the trickle-feed line to the bilge pump, if such a pump is fitted. The scribed mark on the cock should be at right-angles to the pipe when the cock is closed.
4. When the engine has stopped switch off the current by turning the key switch to the 0-position. Neglecting to do this will cause the batteries to discharge. If the engine is to remain idle for 24 hours or more, the master switches should also be switched off. The volt meter is wired directly over these switches.

NOTE! The master switches must not be switched off while the engine is running, otherwise the charging regulator can be damaged.

All fuel cocks and the bottom valve should be closed.

5. If there is any risk of frost, follow the recommendations given under "Precautions in case of frost", in order to avoid damage to the cooling system.

Get-you-home device

Reverse gears of type SCG MRF350 HDMK3, as standard are equipped with a mechanical safety clutch.

In the event of a serious breakdown of the reverse gear hydraulic system, or excessive slipping when attempting forward running; the get-you-home device can be engaged in order to reach port.

When engaged, this get-you-home device mechanically locks the input and output shafts together, preventing the disengagement of the reverse gear. The control lever must **unconditionally** be in the "forward" position while the engine is running with the get-you-home device engaged. In any other position the clutch linings will be damaged.

Let a workshop carry out the necessary repairs as soon as possible.

Engaging, SCG MRF 350 HDMK3B

Note! Stop the engine before engaging the get-you-home device. Serious bodily injury can result otherwise

Remove the cover with the oil pump, which is located on the port side of the reverse gear. Screw in the three screws alternately until all the screws are properly tightened. Use a hexagonal wrench (5 mm.).

Precautions in case of frost

When the engine is stopped and there is risk of frost, the cooling **sea water system** should be drained in order to prevent the cooling jackets and pipelines from being damaged by frost.

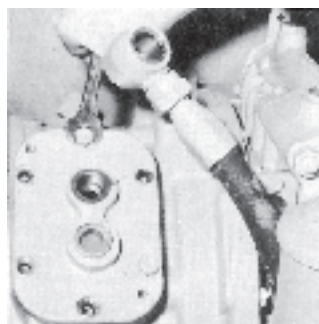


Fig. 27. Removing the oil pump, SCG.

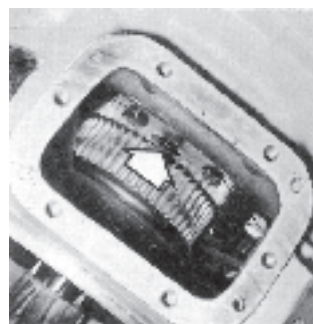


Fig. 28. Locking screws for get-you-home device, SCG.

The freshwater system should also be drained or Volvo Penta glycol, or another glycol of approved quality, added.

Before draining, stop the engine, remove the filler cap and close the bottom valve. Then open the drain cocks in the fresh water and seawater system. There may also be cocks at the lowest points of the cooling water and the exhaust lines.

Remove the cover on the seawater pump and the cover on any extra bilgepump if fitted. Check to make sure that all the water runs out.

Bilge-pump the boat and make sure there is no leakage anywhere.

Propeller shaft brake

For certain stipulated conditions of operation a propeller shaft brake may be necessary, due to the fact that the propeller shaft may be caused to rotate by forces acting upon the propeller, when the engine is shut down. This can damage the reverse gear. The reason for this is that the hydraulically operated reverse gear lubrication is insufficient since the oil pump is driven by the input shaft which is stationary together with the engine.

A special oil pump for the circulation of lubricating oil can, however, be fitted to the SCG-reverse gear. This pump, which is driven by the output shaft should be ordered at the same time as the reverse gear (not included in Volvo Penta's standard range). If this pump is fitted, the shaft can "trail" for unlimited periods of time, no shaft brake is needed. The pump cannot be fitted to previously installed reverse gears.

The propeller shaft may be allowed to rotate, whilst the engine is shut down, for up to 24 hours. It is however, if possible, advantageous to run the engine for a short while after every 8 hours for lubrication and cooling of the reverse gear. In cases where the shaft rotates faster than during normal operation, whilst under sail, for example, a temperature gauge should be connected to the reverse gear, in order to monitor the oil temperature. Max. allowable temp. for SCG reverse gear: 70°C (158°F) and for Twin Disc reverse gear 110°C (230°F).

If the above regulations cannot be fulfilled a propeller shaft brake must be fitted (in exceptional cases the reverse gear carrier may be disconnected).

Borg Warner reverse gears do not require a propeller shaft brake for engines whilst under sail or in the case of twin engine installations when one engine is shut down. The oil level should, however, be checked carefully under these conditions of operation, as well as during normal operation.

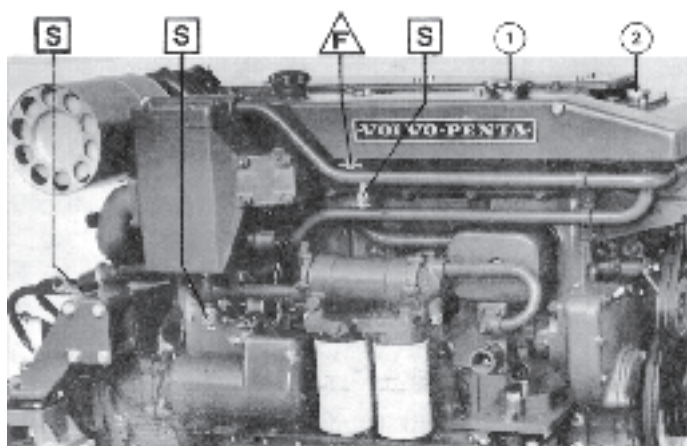


Fig. 29. TAM60

F = Fresh water cocks
S = Seawater cocks
1 = Cap, topping-up, fresh water
2 = Plug for filling larger amounts of fresh water

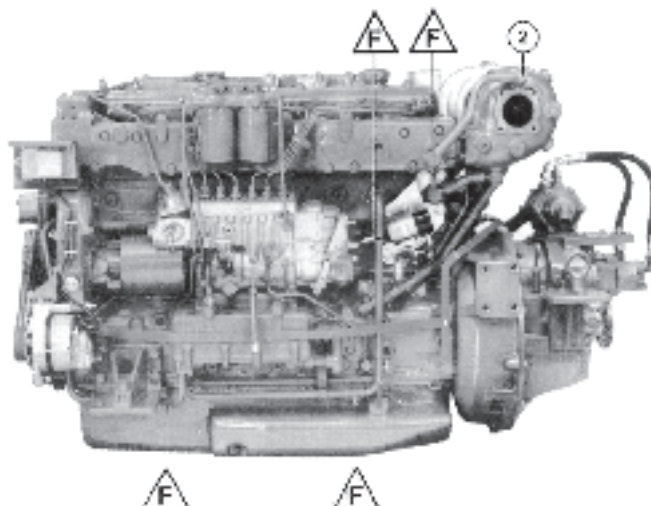


Fig. 31. All engines (The cocks are similarly placed.) The dotted lines apply only to AQD70D, TAMD70D engines

F = Fresh water cocks
2 = Venting cock

Anti-freeze

During the cold season, suitable anti-freeze should be added to the cooling water in the fresh water system.

We recommend that you use our ethylene glycol (red, part number 283241 in cans of 4.5 litres = 1 Imp.gall. = 1.2 U.S.gall.), which have the right amount of additive for neutralizing corrosive matter that may be in the cooling water.

If Volvo's red glycol is used, it is sufficient to change the coolant once a year, preferably in the autumn (fall).

Never use anti-freeze which is not approved. Among other things, certain types of anti-freeze can cause corrosion in the engine.

Methylated spirit of any kind should not be used since it evaporates fairly quickly. It also increases the risk of corrosion in the cooling system.

At least 40% glycol should be used in order to avoid corrosion.

Flush the cooling system clean before filling it with antifreeze. Check hoses and connections and remedy any leakage.

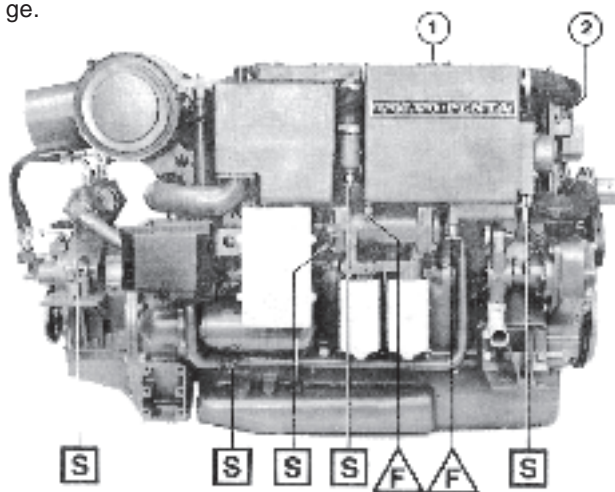


Fig. 30. AQD70C, TAMD70C

F = Fresh water cocks
S = Seawater cocks
1 = Fresh water filler cap
2 = Venting cock

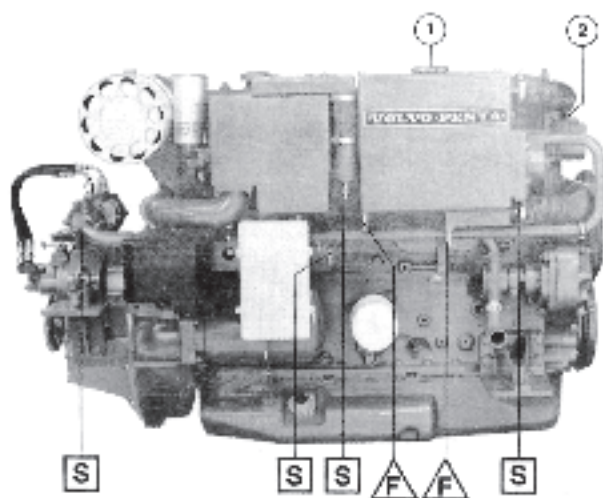


Fig. 32. AQD70D, TAMD70D

F = Fresh water cocks
S = Seawater cocks
1 = Fresh water filler cap
2 = Venting cock

Cooling system capacity dm ³ (l) (Imp. gall. = US gall) approx.:	Amount, dm ³ (litres) (imp. gall. = US gall.) of glycol necessary for frost protection down to approx.:		
	-25°C (-13°F)	-30°C (-22°F)	-40°C (-40°F)
TAMD60A, B 20 (4.4 = 5.3)	8.5 (1.9 = 2.1)	9.5 (2.2 = 2.5)	11 (2.4 = 2.9)
TAMD60A, B 23 (5.1 = 6.1)*	9.5 (2.2 = 2.5)	11 (2.4 = 2.9)	13 (2.9 = 3.4)
AQD70C, TAMD70C 28 (6.2 = 7.4)	11.5 (2.5 = 3.0)	13 (2.9 = 3.4)	15.5 (3.4 = 4.1)
AQD70D, TAMD70D 30 (6.6 = 7.9)	12.3 (2.7 = 3.2)	14 (3.1 = 3.7)	16.7 (3.7 = 4.4)

*Incl. separate expansion tank.

NOTE! If water without glycol is used during the summer do not add anti-corrosion agent which can damage the light-alloy parts in the cooling system. In order to avoid corrosion, the easiest method is to use a suitable mixture of Volvo Penta red glycol all year round. It should be changed every autumn.

Engine lubricating oil

The engine requires high-class diesel engine oil in order to maintain good running economy and maximum performance. It is an absolute requirement that the correct quality of lubricating oil is used according to our recommendations.

Note that our warranty does not apply if the engine is run with the wrong lubricating oil.

We recommend that you use Volvo Penta diesel engine lubricating oil which is on sale at our service stations.

Quality and viscosity

The lubricating oil should meet the requirements according to one of the following standards:

Designation	Standard
CD (For service DS)	API (American Petroleum Institute)
MIL-L-2104C	US Government's Military
(L-45199B)	Specification
Series 3	Caterpillar Tractor Co. Specification.

When buying lubricating oil, always make sure that the oil container is marked with the oil designation in question, and check with each oil company that they guarantee that the oil they sell satisfies the demands made in the classification standards mentioned above.

The **viscosity** used will depend on the ambient air temperature. See page 21.

Reverse gear lubricating oil and hydraulic oil

For the reverse gear and hydraulic equipment the same lubricating oil is used as for the engine. Concerning disengageable clutches with reduction gear, see "Technical data".

Fuel

The diesel fuel oil used in the engine must satisfy certain quality demands and must primarily be free from solid impurities and water. The sulphur content should also be as low as possible.

If low quality fuel is used, this can give rise to abnormal wear, running interruptions and smokey exhaust emissions.

Diesel fuel oil must satisfy the demands according to the standard SIS 155432 or Volvo Group Standards (Diesel fuel oil 97963-02).

A few of the points in the Volvo Standard concerned are given below:

Cetane rating	min 45
Viscosity at 20°C (68°F)	2.0–6cSt
Lowest pour temperature	
summer grade	–10°C (+14°F)
winter grade	–25°C (–13°F)
Flash point	40°C min (104°F)
Solid impurities	None
Sulphur content	Max. 0.5 % by weight

The fuel oil property requirements stated above are also covered, to a large extent, by the following standards.

DIN 51601, CEC-ERF-D1 or ASTM-D975-No. 2-D

Fuel oils complying with these standards can, therefore, also be used.

Electrical system

As standard, the engines are equipped with a two-pole electrical system and an alternator. See pages 42-47 for the wiring diagrams. Engine TAMD60 has a voltage of 12 V (alt. 24 V) whereas the 70-series engines have a voltage of 24 V (alt. 12 V) as standard.

1. Never break the circuit between the alternator and batteries while the engine is running. The master switch must not be switched off until the engine has stopped completely. No cable may be disconnected while the engine is running as this too can damage the charging regulator.
2. The batteries, battery cables and cable terminals should be checked regularly. The battery poles should be well cleaned and the cable terminals firmly tightened and greased so that no interruption occurs. All cables should be well tightened. No loose connections are permitted. Note! When fitting the battery be absolutely sure not to confuse the plus and the minus poles. See the appropriate wiring diagram.
3. When starting with the help of a spare battery, first check that the spare battery has the same rated voltage as the standard one. Connect the spare battery to the standard battery, plus to plus and minus to minus. Remove the spare battery when the engine has started. Note! The circuit to the standard battery must not be broken.
4. If electrical welding work is to be carried out on the engine or installation units, disconnect the charging regulator and insulate the leads. Also, disconnect both the battery terminals. Never connect the welding cables so that current passes through a bearing.
5. Should repair work need to be carried out on the alternator equipment, the battery leads should be disconnected first. This also applies if the batteries are to be rapid-charged.
6. Never test with a screwdriver, etc against any terminal to see if it is live.

Servicing scheme

The numbering in the scheme below lists the servicing operations described in the following pages under the corresponding numbers. Servicing work requiring the attention of experienced mechanics and the use of special tools is marked with an "A" and should, therefore, be carried out by authorized service personnel.

Daily

1. Check the oil level in the engine
2. Check the oil level in the reverse gear
3. Check the coolant level and the seawater filter (optional equipment).
4. Lubricate disengageable clutch (optional equipment)
5. Check the oil level in the reduction gear (optional equipment).

Every 50 hours

6. Lubricate disengageable clutch (optional equipment)
7. Check the oil level in the hydraulic tank (AQ-type)
8. Check the batteries.

Every 100 hours

9. Change the oil in the engine.
10. Check (drain) extra fuel filters.

Every 200 hours

11. Lubricate disengageable clutch (optional equipment)
12. Replace inserts in the extra fuel filters.
13. Replace the fine filters in the fuel system¹⁾
14. Vent the fuel system.
15. Check/tension the V-belts
16. Check the air lines, oil and cooling pipes at the turbo for leakage.
17. Check the zinc electrodes. Clean the seawater filter (optional equipment).

Every 600 hours

18. Replace the engine lubricating oil filters.
19. Change the oil in the reduction gear (optional equipment).
20. Check the valve clearance (A)
21. Air cleaner. Clean on 70C-engine. Replace on all other engines. Replace the crankcase ventilation filter.
22. Check the injectors (A).
23. Check and if necessary clean the cooling system.
24. Lubricate the starter motor.
25. Check/adjust disengageable clutch (optional equipment).

Every 1200 hours

26. Replace the filter element and oil in the hydraulic system (AQ-type).
27. Change the oil in the reverse gear. Replace the filter element (SCG), and clean the suction strainer on other types of reverse gear. Check the reverse gear.
28. Check the starter motor and alternator. Lubricate the large alternator (1600 W). Optional equipment.

Every 2400 hours or when necessary

29. Check/clean the heat exchanger and after-cooler.
30. Check/clean the engine and reverse gear oil cooler.
31. Replace the impeller in the seawater pump (preferably at the beginning of the season).
32. Check the injection pump (A).
33. Check the turbo-compressor for leakage, bearing clearance and charging pressure (A).
34. Check the engine and its equipment in general (A)
35. Inhibiting (when laying-up).
36. De-inhibiting (when launching).

All the measures listed above (except for No. 32) should be carried out at least once a year, even if the running time in the schema has not been reached.

¹⁾ The interval can be increased to 400-500 operating hours under favourable conditions.

Lubrication and checks

Daily

1. Engine oil level

Check the oil level **daily** with the engine switched off. Wipe the oil dipstick with a clean cloth. Do not use cotton waste. The level should be between the two marks on the dipstick. Never below the lower mark. For changing the oil, see pages 19 and 20.

The fuel injection pump and the turbo-compressor are automatically lubricated through the engine lubricating system. The fresh water pump and the seawater pump are lubricated at the factory and further lubrication is therefore not required.

Engine oil

Quality

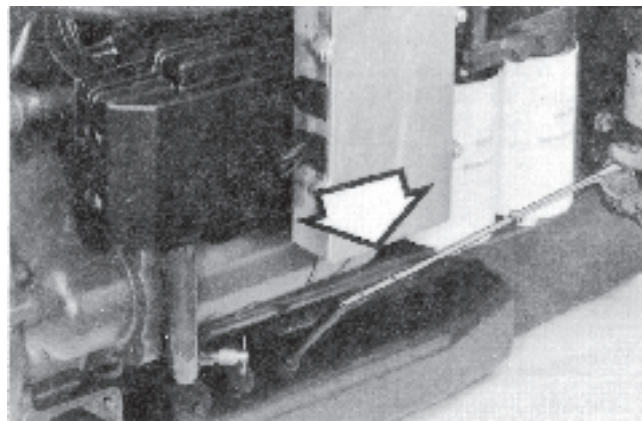
according to API CD (For service DS)

Viscosity

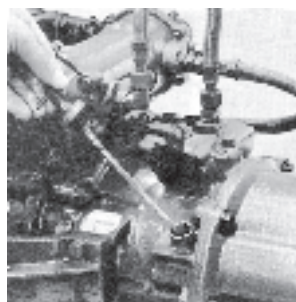
above +20°C (68°F) SAE 30
 between +20°C and -10°C: SAE 20/20W } or 15W/40
 (+68°F and +14°F)
 below -10°C (+14°F) SAE 10W

Engine	Volume incl. filters			Engine inclination (max. 18° underway* (max. 15° when installed)
	dm ³ (litres)	Imp.gall.	US gall.	
AQD70	27.0	6	7	0°
TAMD70	27.0	6	7	0°
	16.0	3.5	4.2	18°
TAMD60	20.0	4.4	5.3	0°
	13.0	2.9	3.4	18°

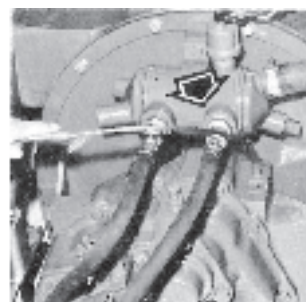
*For TAMD60 20° applies under way



Oil dipstick, similarly located for all engines.



Oil dipstick BW73CR and BW 10-05 (60 engines)



Oil dipstick, reverse gear TD502 (60-engines)

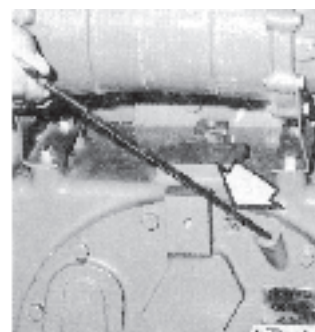
2. Reverse gear oil level

Check the oil level **daily** with the dipstick and add oil if necessary. When checking the oil level in the Twin Disc reverse gear, the engine should be idling and the operating control in neutral position.

The oil level in the Borg Warner and SCG reverse gears should be checked when the engine is not running. The level will lie above the "max" mark when the engine has been switched off for a sufficiently long period of time to allow the oil to run down from the cooler and passages. In order to obtain a true level reading, check immediately after the engine has stopped. Regarding changing oil, see page 31.



Oil dipstick, reverse gear TD506 (70-engines)



Oil dipstick, reverse gear SCG (70-engines)

Reverse gear lubricating oil

Engine oil of same quality and viscosity as in engine*	Oil capacity, approx. (incl. cooler)		
	dm ³ (litres)	Imp.gall.	USgall.
Borg Warner 73CR*	2.5	0.5	0.7
Borg Warner 10-05* V-drive	5.5	1.2	1.5
Twin Disc, MG 502	2.5	0.5	0.7
Twin Disc, MG 506	6.5	1.4	1.7
SCG MRF 350 HDMK3	12.5	2.7	3.3

* Oil viscosity for Borg Warner, SAE 30.

3. Engine coolant level

Check the level **daily** before starting.

NOTE! Open the coolant filler cap carefully when the engine is hot.

For the TAMD60 engines fitted with a separate transparent expansion tank the level should be between the "max." and "min." marks.

On other engines, when cold, the level should be approx. 5 cm below the sealing surface of the filler cap so that the coolant can expand when the engine becomes warm.

When there is danger of frost, the system should be drained or anti-freeze added. See under "Precautions in case of frost".

When filling the coolant, remember to open the air venting cocks in order to avoid air pockets. There is a venting cock on the water pipe at the turbo. For the 70-engines there is also a venting cock situated at the front of the thermostat housing.

On the TAMD60-engines, small quantities of coolant required for topping-up can be added to the expansion tank, but otherwise the coolant should always be filled directly into the heat exchanger through the hole for the hexagon plug until the engine is completely full and air-vented. Then close the venting cock at the turbo and refit the hexagon plug on the heat exchanger. **Thereafter fill** the expansion tank with approx. 3 litres (0.7 Imp. gall.=0.8 US gall.) and refit the cap.

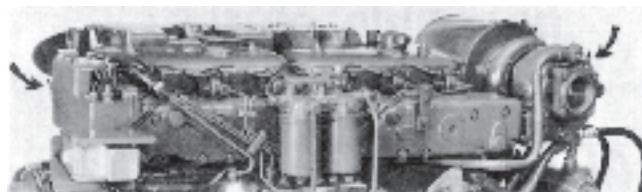
If there is a separate transparent expansion tank this should be filled last to slightly above the MIN-level, after having first completely filled the engine's expansion tank.

If the engine is connected to a heating radiator, this must also be air-vented before the cap or plug on the heat exchanger are fitted. Otherwise the engine may be damaged due to insufficient cooling.

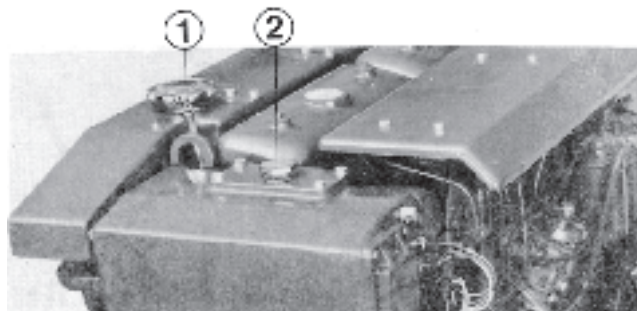
If the engine runs abnormally hot, vent the cooling system and top up with water.

Anti-corrosion additives should not be used since parts of the cooling system are made of light-alloy.

The seawater filter (optional equipment) should be checked daily. With regard to cleaning, see page 28.

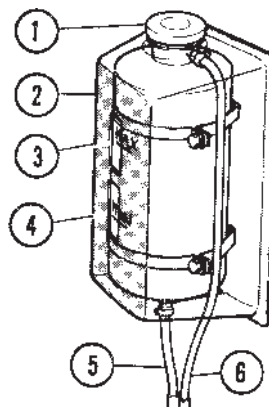


Venting cocks



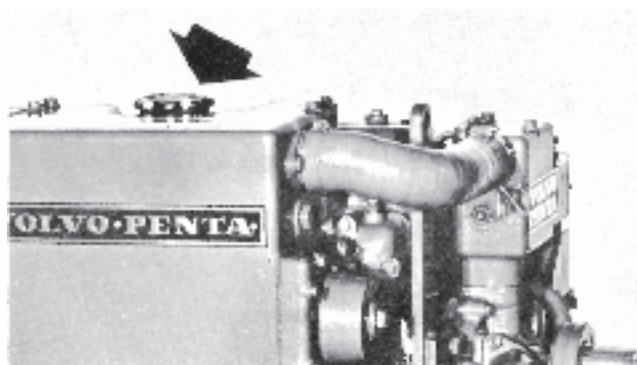
TAMD60

1. Cap on expansion tank. Topping-up.
2. Hexagon plug on heat exchanger. Filling.



Separate expansion tank

1. Over-pressure cap
2. Cover
3. Max. level
4. Min. level
5. Hose from engine
6. Hose with free end



TAMD70, AQD70

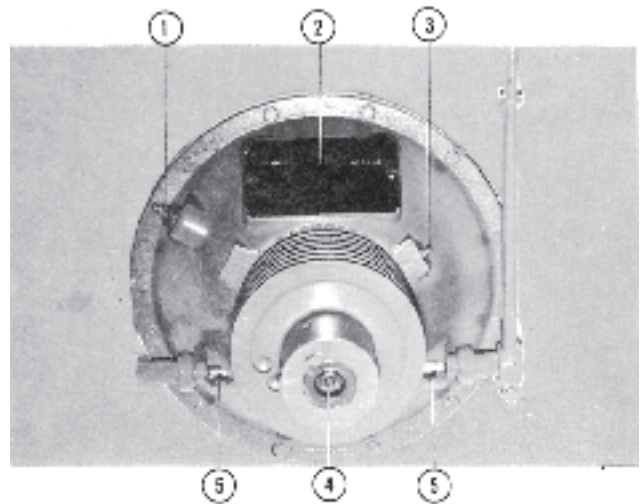
4. Lubricating-disengageable clutch, reduction gear

Optional equipment, TAMD70D.

Lubricate the throw-out bearing (nipple 1) **daily**, before starting.

NOTE! Lubricate sparingly, to avoid risk of excess grease finding its way onto the dry clutch linings and causing slip.

Use multi-purpose heat resistant grease.



Extra power take-off at front end. Rockford/BW (1:1)

5. Checking oil level in reduction gear

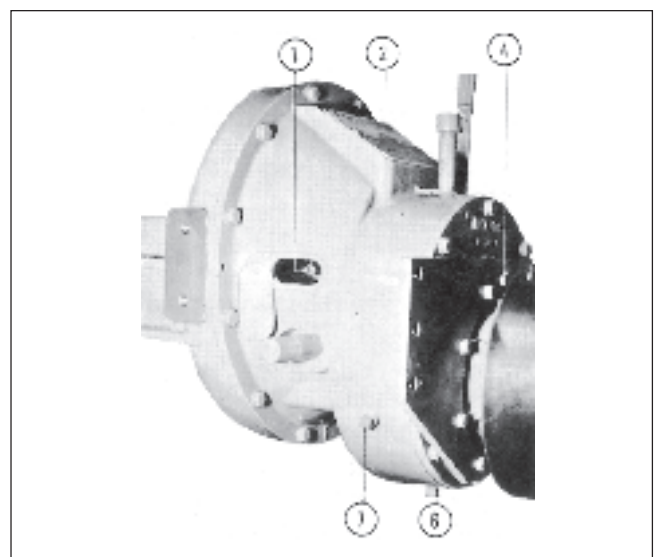
Optional equipment, TAMD70D

Check the level **daily** before starting.

The oil should be filled up to the level plug (7). Top-up with oil if required. Regarding oil quality and viscosity, see table below. Concerning oil changing, see page 28.

Lubricating oil for reduction gear

Clutch with reduction gear	Oil grade	Viscosity	Capacity, dm ³ /litres (qts.)
Rockford/BW 203 mm (8")	Engine oil	SAE 30	approx. 1 (1)
254 mm (10")	Engine oil	SAE 30	approx. 1.5 (1.5)
Twin Disc	Engine oil, or Hypoid oil	SAE 40 SAE 80	approx. 1 (1)



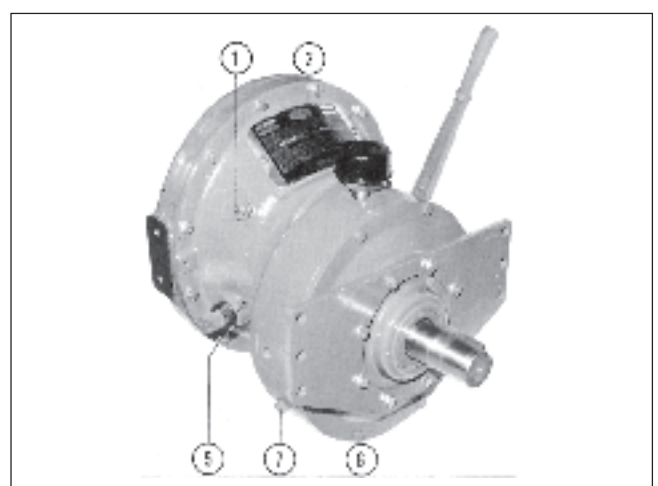
Extra power take-off at front end, Rockford/BW (2.8:1)

Every 50 hours

6. Lubricating-disengageable clutch, reduction gear

Optional equipment, TAMD70D

Lubricate the inner support bearing (nipple 4) every **50 hours**. Unscrew the plug (4) for Rockford/BW 203 mm (8") power take-off with reduction gear. Use multi-purpose heat resistant grease.



Extra power take-off at front end, Twin Disc (3:6:1)

Picture text for extra power take-offs at front end

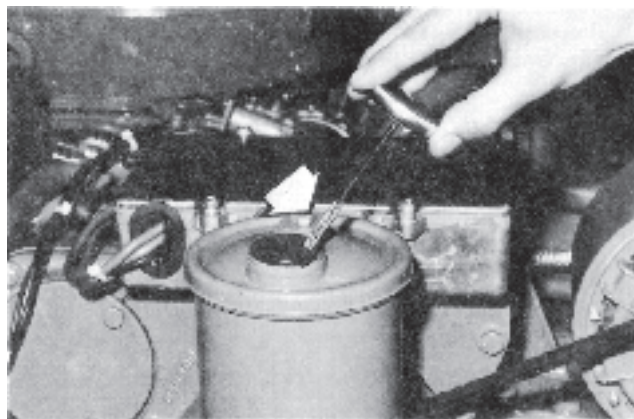
- | | |
|------------------------------------|--|
| 1. Nipple for throw-out bearing | 4. Nipple for support bearing |
| 2. Inspection cover | 5. Nipples (2 x) for disengagement shaft |
| 3. Nipple for output shaft bearing | 6. Drain plug |
| | 7. Level plug |

7. Hydraulic system, oil level

AQD70. Optional equipment for all other engines.

Check the level after every **50 hours** of operation. The engine should be idling.

1. Remove the filler cap on the hydraulic tank.
2. Wipe the dipstick, and check the level which should be at the max. mark on the dipstick.
3. Fill with engine oil, if necessary. The oil quality is the same as in the engine,

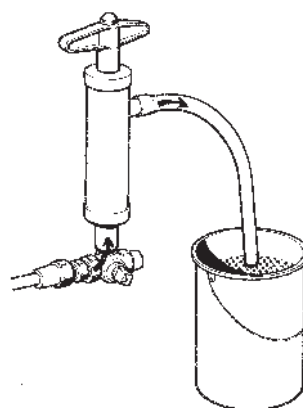


8. Checking batteries

Check the electrolyte level in the batteries every **50 hours** or more often. The level should be about 10 mm above the cell plates. Top-up with distilled water if necessary. Also make sure that the cable terminals are properly tightened and greased.

Check the state of charge of the batteries with the aid of a hydrometer if the voltage is low.

The density of the electrolyte should be 1.28 g/cm³. If it has fallen to 1.23 the batteries should be re-charged. If a rapid charger is used, first disconnect the battery cables, (both the + and the - cables).



Oil being pumped out of the engine. 70-series

Every 100 hours

9. Engine, changing oil

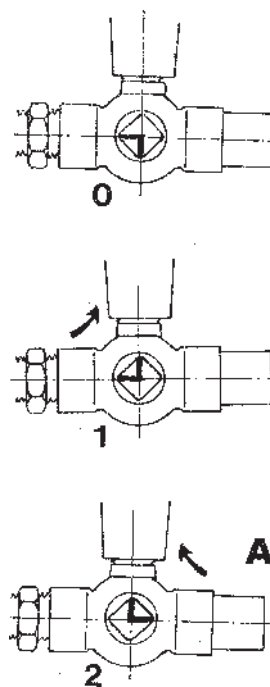
Change the oil in the engine after every **100 hours** of operation and when the engine is warm. However, during the running-in period the oil should be changed for the first time after 25 hours of operation. Do not use flushing oil for cleaning the crankcase. Only drain (pump out) the old oil carefully.

NOTE!

Collect the old oil carefully and hand it over to a service station or disposal depot. Never pollute the water by discarding the oil over board.

AQD70C, TAMD70C, changing oil

1. Open the cock at the oil scavenging pump (position 1) and pump the oil over into a vessel.
2. Close the cock and fill with engine oil through one of the rocker arm casings after the ventilation cap has been removed. See page 21 concerning the amount of oil to be filled.
3. Start the engine and allow it to idle for a minute or so.
4. Stop the engine and check the oil level. **Top up if necessary. Note! The cock at the scavenging pump should be closed when the engine is running. Position 0.**



Cock under oil scavenging pump, 70C-engine

0 = Closed cock

1 = Emptying crankcase

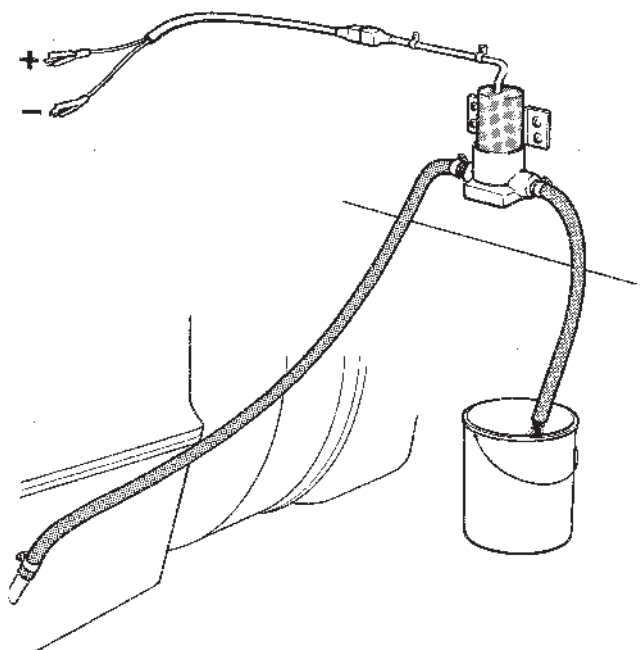
2 = Emptying reverse gear

A = Free end of cock

The cock must be closed when running.

All other engines, changing oil

1. Remove the oil dipstick and connect the hose from the oil scavenging pump to the pipe for the dipstick. (Outer diameter of pipe, 13 mm). An electric scavenging pump is available as optional equipment.
2. Start the pump and collect the oil in a vessel.
3. Fill oil through the hole for the ventilation cap on the rocker arm casing. It is also possible to use the scavenging pump when filling with oil by reversing the polarity of the pump motor (reversing the + and - cables.) Regarding the capacity, see page 16. Insert the oil dipstick and check the level.
4. Start the engine and allow it to idle for a few minutes.
5. Stop the engine, check the oil level and top-up if necessary.



Electrically driven oil scavenging pump

10. Fuel filters

(Optional equipment) Checking

Check the fuel filter and drain any water that may be in it after every **100 hours** of operation by opening the cock or removing the drain plugs. The check should be made with the engine switched off and only after it has been off for a few hours. Close the cock or fit the plugs and vent through plug 1 or cock 3.

Every 200 hours

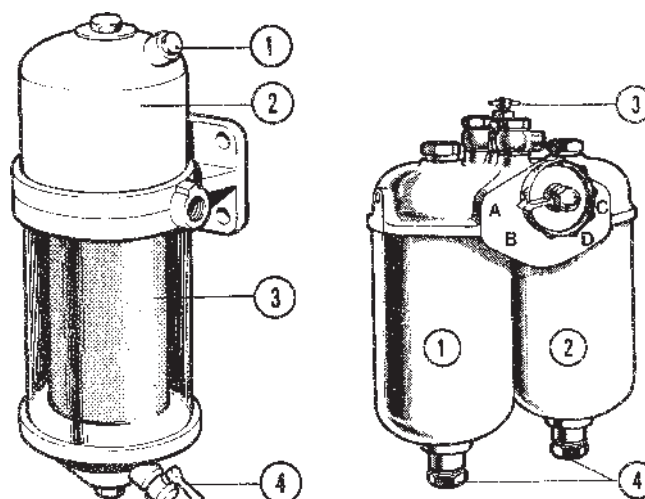
11. Lubricating-disengageable clutch, reduction gear

Extra equipment, TAM70D

Lubricate the shaft ball bearings (nipple 3) and the disengagement shaft bearings (with lubricating nipples (5), if fitted) every **200 hours**.

Check, through the cover (2), the moving parts of the clutch mechanism. Lubricate if necessary with a few drops of thin oil.

The figures refer to the figures on page 23.



Cleaning extra fuel filters

Single filter

1. Venting plug
2. Upper housing
3. Lower housing
4. Drain cock

Double filter

1. Filter housing number 1.
2. Filter housing number 2.
3. Venting cock
4. Drain plugs

12. Fuel filters

(Optional equipment). Replacing elements

Note. Clean the filter housings carefully on the outside before loosening them and make sure that no impurities enter the fuel system.

The elements in the double filter can be replaced and the filter cleaned whilst running.

- A. Filter 2 engaged. Vent filter 1.
- B. Filter 2 engaged. Clean filter 1.
- C. Filter 1 engaged. Vent filter 2.
- D. Filter 1 engaged. Clean filter 2.

Normal running B or D. Alternatively

Both elements of the double filter and the lower element of the single filter should be changed after **200 hours** of operation or at least once every season, preferably at the beginning. Close the fuel cocks at the tank and loosen the filter housing by screwing out the centre screw. Clean the filter housings carefully.

The upper element of the single filter should be changed once a year.

Use new gaskets when reassembling.

Vent the filters before starting through the plug 1 or the cock 3.

13. Replacing fine filters

Replace both fuel fine filters after every **200 hours** of operation. Under favourable conditions, i.e. if the fuel is of a very high quality and free from impurities, the interval between replacing the filters can be extended to **400-500 hours** of operation.

However, the filters should be replaced at least once a year, preferably at the beginning of the season.

At the same time replace the elements in the extra fuel filters. See point 12.

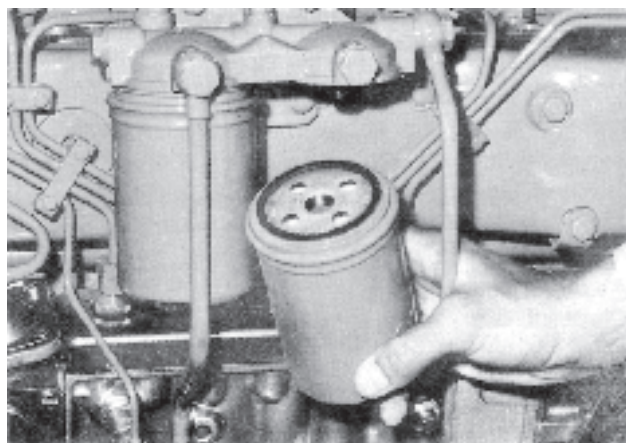
When working with the fuel system the highest possible degree of cleanliness should be exercised in order to prevent impurities entering the fuel system.

Replacing

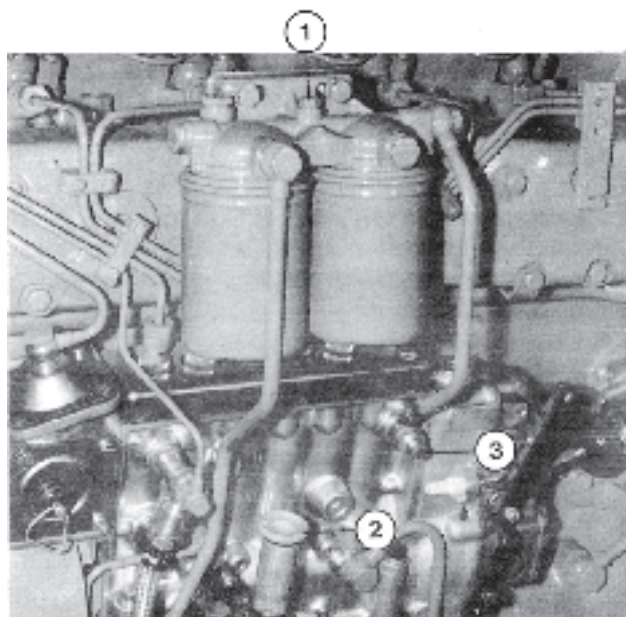
1. Wash the filter head carefully, especially at the lower edge, then screw off both filters and discard them.
2. Check that the new filters are absolutely clean and that the gaskets are undamaged.
3. Screw on the filters by hand until the gaskets touches the filter head. Then tighten them one further half turn but not more.
4. Vent the fuel system according to the following paragraph and pump up the fuel feed pressure. Check for leakages.

14. Fuel system, venting

1. Open the venting screw (1) on the filter head of the fine filters and pump up the fuel with the hand primer (2) until the fuel is free from air bubbles. Tighten the screw. (The handle on the pump is released by screwing anti-clockwise.)
2. Open the venting screw (3) on the fuel injection pump and pump up fuel until all air bubbles in the fuel disappear. Then tighten the venting screw. (**Applies only to AQD70, TAMD70.** The pump on TAMD60-engines is vented directly through the fine filters.) Pump further to ensure that proper feed pressure is obtained.
3. Start the engine. If the engine does not start almost at once, slacken the delivery pipes at the injectors a couple of turns. Then run the starter motor until fuel runs out. Tighten the delivery pipes and then start the engine.



Replacing the fine filters



15. V-belts, checking

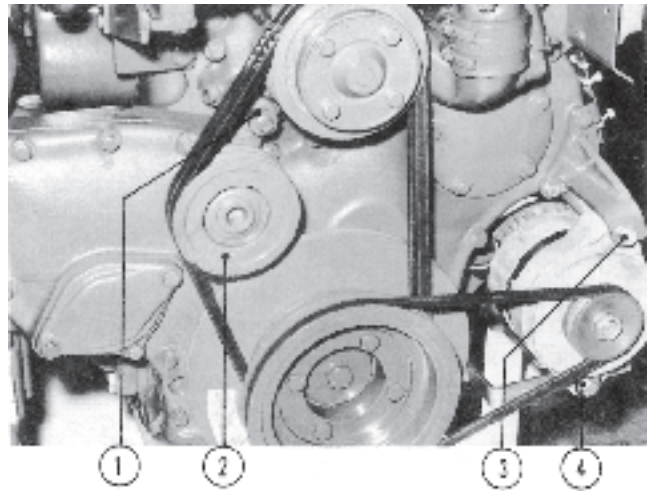
After every **200 hours** of operation check that the belts are properly tensioned and that they are not worn.

It should be possible to depress the belts about 10 mm midway between the pulleys if they are properly tensioned.

The belts for the circulation pump are tensioned, after nut (1) has first been slackened, by moving the tensioning pulley (2) outwards.

The belts for the large alternator (1600W) are tensioned after first having loosened the 4 attaching screws. For the smaller alternators slacken the attaching screw (3) and the tensioner bracket screw (4).

Belts operating in pairs should always be replaced simultaneously.



The belts are tensioned in the same way on all engines.

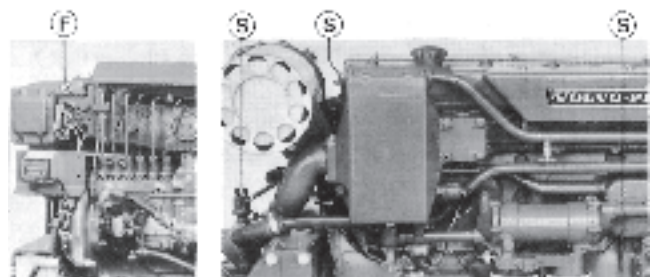
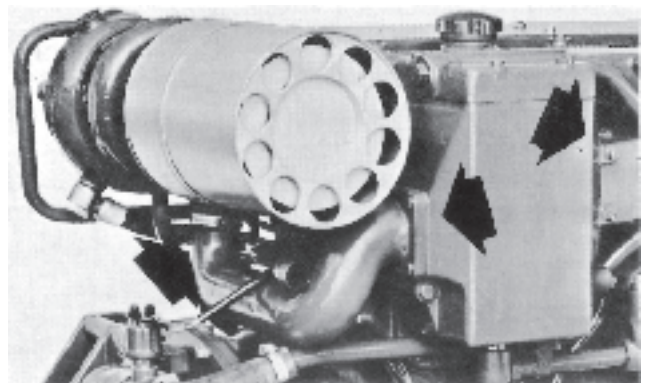
16. Turbo-compressor, checking for leakage

Check for leakage after every **200 hours** of operation. Air leakage will lower the engine output and cause smokey exhaust gases.

Check that there is no leakage in the air lines by listening carefully along them while the engine is running. A whistling or hissing sound indicates leakage. Leakage can also be detected by applying soapy water to suspected areas on the discharge side between the turbo and the engine.

Tighten the hose clamps or replace the hose if necessary.

Any leakage in the lubricating oil and cooling water lines must be remedied immediately in order not to impair the function of the turbo-compressor.



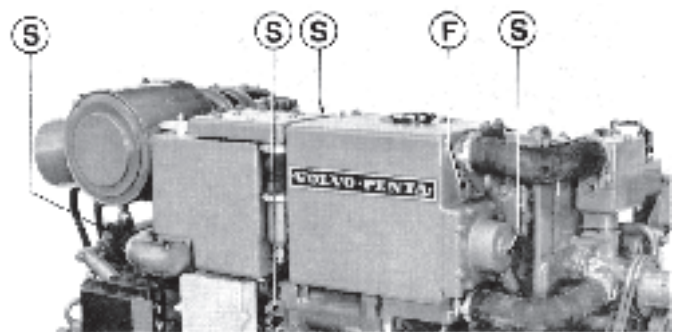
TAMD60

17. Zinc electrodes, checking

Check the zinc electrodes after every **200 hours** of operation. First close the bottom valve and drain off some of the coolant. Screw out the electrodes and scrape or brush off any deposits. If about 50 % of an electrode is used up, the electrode should be replaced. **Make sure when fitting an electrode that there is good metal contact between the electrode and the part of the engine to which it is fitted.**

If any of the electrodes is not attacked by corrosion, then the reason can be poor contact between the electrode and the engine. Scrape the surface clean and check that the electrode is not loose in its retainer. Replace if necessary.

Close the drain cocks, open the bottom valve. Add the drained coolant which belongs to the fresh water system. Electrodes indicated by an S in the adjoining figures belong to the seawater system and those indicated by an F to the fresh water system.



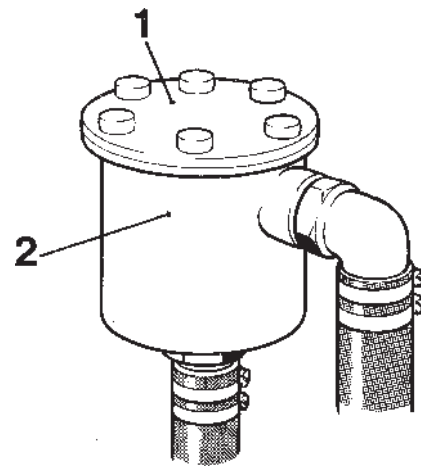
AQD70, TAMD70. (The dotted line applies only to AQD70C, TAMD70C.)

S = Electrodes in seawater system
F = Electrodes in fresh water system

Seawater filter

The filter (optional equipment) should be taken apart and cleaned after every **200 hours** of operation or more often if necessary.

First close the bottom valve. Then screw the attaching screws out of the cover (1). Lift up the cover and the element and clean the element in the housing (2) carefully. Refit the parts, open the bottom valve and check that there is no leakage.



Seawater filter

1. Cover, transparent
2. Housing with element

Every 600 hours

18. Lubricating oil filters, replacing

Replace the lubricating oil filters after every **600 hours** of operation, or at least once a year, although during the running-in period after the first **100 hours**.

1. Unscrew the oil filters and discard them. On **AQD70D** and **TAMD70D** there is **only one filter**.
2. Oil the rubber gaskets on the new filters and check their contact surfaces on the engine.
3. Screw on the new filters until the gaskets make contact. Then tighten a further half turn but no more.
4. Check for leakage after starting the engine.
5. Check the oil level in the engine.

19. Changing oil in the reduction gear

Optional equipment, TAMD70D

Change the oil after every **600 hours** of operation or at least once a year.

During the running-in period the oil should be replaced after the first 100 hours of operation.

Drain the oil through the bottom plug (6), see figures page 18. Alternatively the oil can be sucked out with the help of the oil scavenging pump.

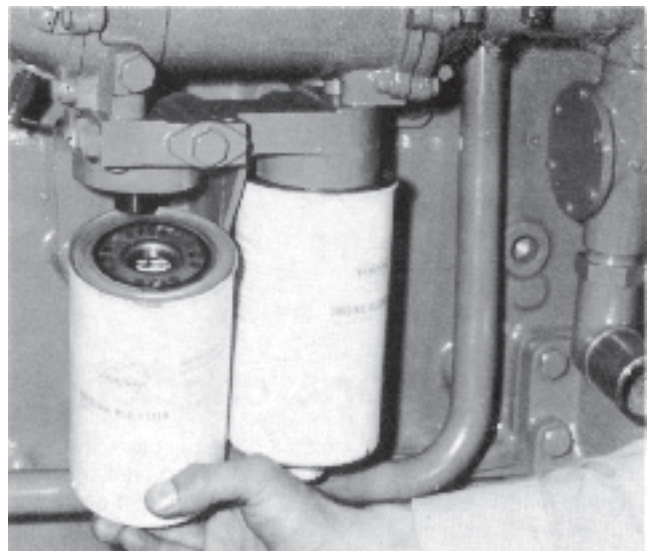
Collect the oil carefully and hand it over to a service station or disposal depot. Never pollute the water by discarding the oil overboard.

Clean the ventilation cap above the filler opening on the Twin Disc reduction gear in connection with changing the oil.

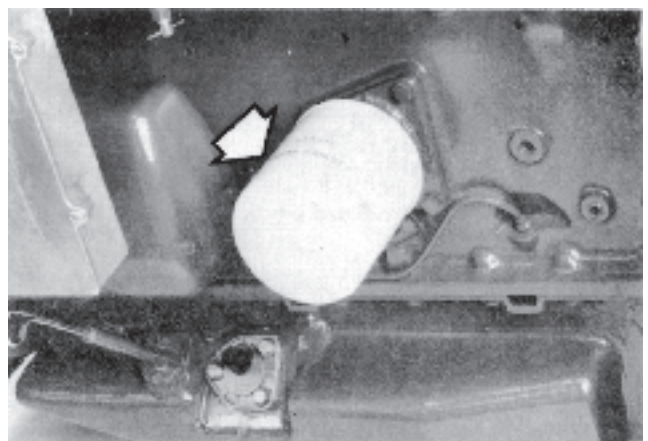
Concerning oil quantity and quality, see "Technical data".

20. Valve clearance, checking

Check the valve clearance after every **600 hours** of operation, or at least once a year. This should be carried out by authorized service personnel. Concerning clearances, see under "Technical data". **Note! The clearance must never be checked while the engine is running, but should always be carried out with the engine switched off, either with a cold engine or when it is at operating temperature.**



Replacing the lubricating oil filters, TAMD60, AQD70C, TAMD70C



Oil filter, AQD70D, TAMD70D

21. Air cleaner

TAMD70C, AQD70C

Clean the cleaner after every **600 hours** of operation.

Undo the clamps round the cleaner and remove and wash the filter element in white spirit or diesel fuel oil. Allow the filter element to drip-dry and then moisten it with engine lubricating oil and refit it.

All other engines

Replace the filter with a new one after **600 hours** of operation. Under favourable conditions the time between the changes can be extended.

1. Clean the rubber tube to the filter. Slacken the hose clamp (1) and the attaching strap (2) for the filter.
2. Remove the old filter and discard it.
3. Check that the rubber tube is not damaged. Fit the new filter after making sure that it is absolutely clean.
4. Start the engine and check that there are no leakages.

NOTE! Make absolutely sure that no impurities enter the engine.

Crankcase ventilation

TAMD60B, TAMD70D and AQD70D have a paper element for the crankcase ventilation. This filter element should be replaced with a new one after every **600 hours** of operation.

22. Injectors, checking

After every **600 hours** of operation the injectors should be cleaned and checked, with regard to opening pressure, spray pattern and leakage, by authorized personnel. For injector values, see "Technical data".

23. Cooling system, checking

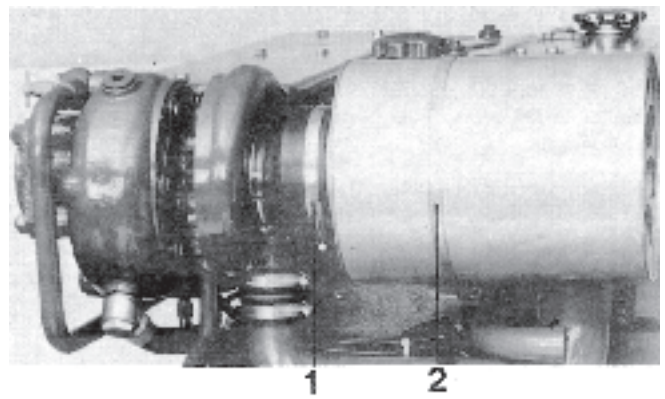
Check the cooling system for leakage and blockage after every **600 hours** of operation or more frequently if necessary.

Flush the cooling system with clean water when filling or draining the anti-freeze. Close the bottom valve before opening the cocks.

If flushing is insufficient, remove and clean the inserts in the heat exchanger, after-cooler and oil coolers. See pages 33 and 34.

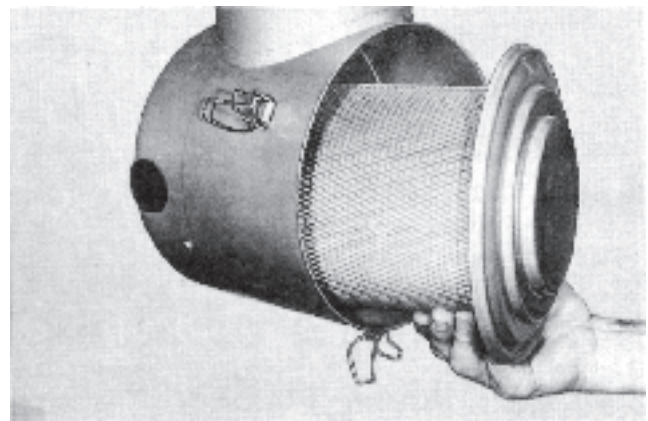
Do not use any type of anti-corrosion agent which can damage the light-alloy in the cooling system.

If a fresh water filter (optional equipment) is fitted on the engine it should be replaced after approximately every **600 hours** of operation.

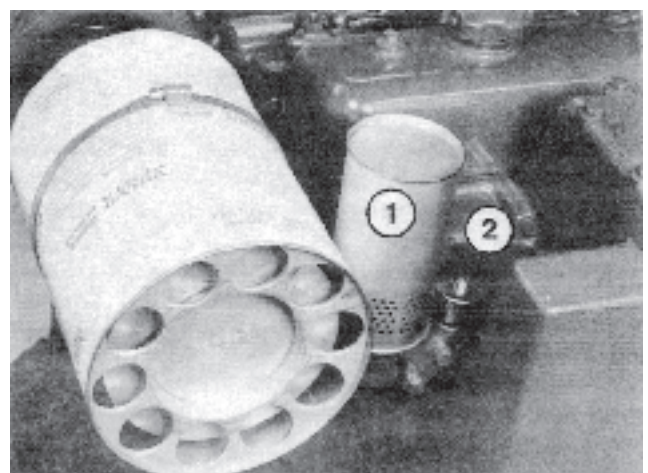


Replacing the complete air cleaner.

1. Hose clamp 2. Attachment strap



Dismantling the air cleaner, AQD70C, TAMD70C



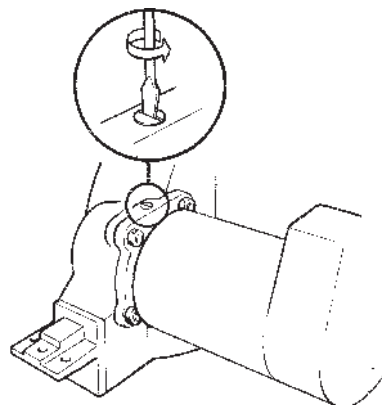
Filter for crankcase ventilation

1. Filter 2. Pressure valve

24. Starter motor, lubrication*

Lubricate the starter motor after every **600 hours** of operation using Bosch oil 5944 290 000. Screw out the slotted screw in the mounting flange against the flywheel housing and fill the hole with oil, refit the screw and tighten it.

*Applies to starter motor type KG(R) which are provided with a lubricating hole as shown in the figure.



Slotted screw for lubricating starter motor KG(R)

25. Clutch -reduction gear, checking and adjusting

Optional equipment TAMD70D

Check the function of the clutch after every **600 hours** of operation.

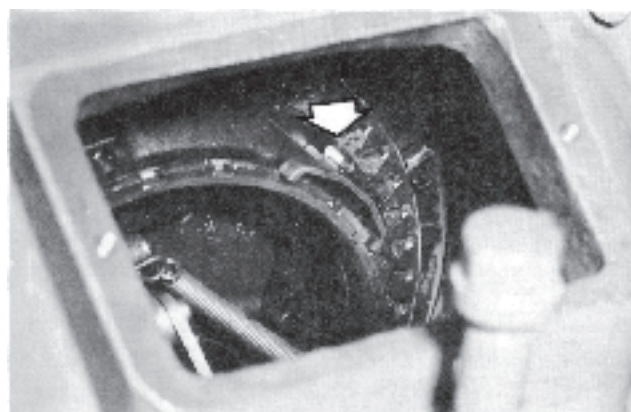
Check to see if the clutch slips, becomes warm or has a tendency to disengage. If the clutch is equipped with reduction gear it should be checked with regard to abnormally high noise level, temperature or leakage.

The Rockford/BW type clutches have a screw on locking plate which retains the adjustment ring in position.

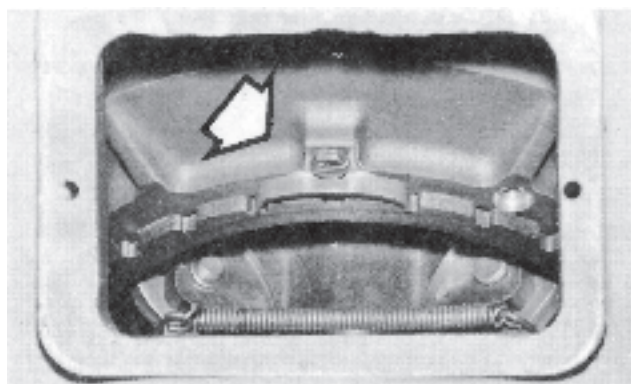
1. Remove the inspection cover. Set the lever to the disengaged position and turn the clutch so that the locking plate becomes accessible.
2. Loosen the locking plate and turn the adjustment ring to the left so many notches that powerful force is required to engage the lever.
3. Screw on the locking plate and inspection cover.

The Twin Disc type clutch is adjusted as follows:

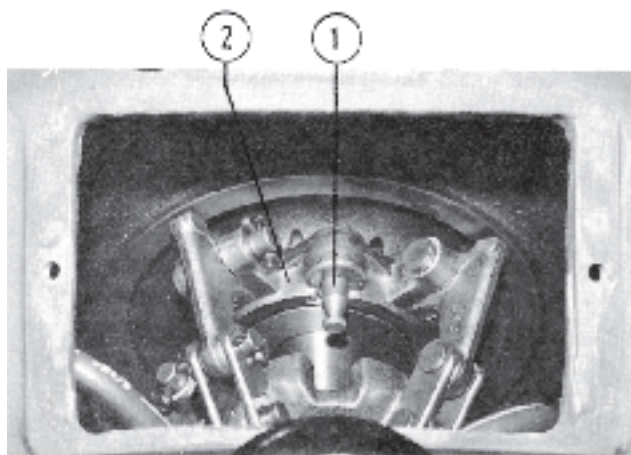
1. Remove the inspection cover. Set the lever to the disengaged position and turn the clutch so that the locking pin (1) becomes accessible.
2. Pull out the locking pin and turn the adjustment ring (2) so many notches to the right that a powerful force is required to engage the lever.
3. Screw on the inspection cover.



Rockford/BW type clutch, 203 mm (8")



Rockford/BW type clutch, 254 mm (10")



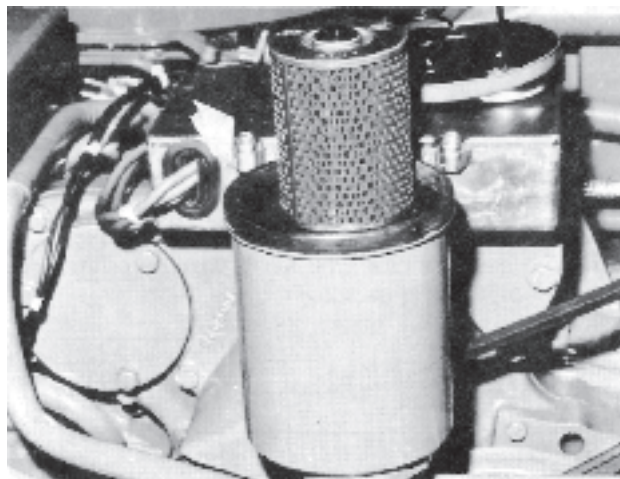
Twin Disc type clutch

Every 1200 hours

26. Hydraulic system

AQD70. Optional equipment on other engines.

Change the oil and the filter element after every **1200 hours**, or at least once a year. See the instruction book for the Aquamatic drive type 750, where venting and changing are described in greater detail.



27. Reverse gear, changing oil

Change the oil after every **1200 hours** of operation or at least once a year. However, for a new or reconditioned reverse gear the oil should be changed for the first time after **100 hours** of operation. When changing the oil the filter element should also be replaced (SCG), for other reverse gears the oil strainer should be cleaned.

Remove the oil dipstick.

Suck up the oil from the **Twin Disc** reverse gear with the scavenging pump, and a hose which is connected to the pipe for the dipstick.

For the Borg Warner and SCG type a pipe can be inserted through the hole for the oil dipstick and the hose can be connected to this pipe by means of a reducing nipple.

Alternatively, the oil can be drained off by removing the bottom plug.

Collect the used oil and hand it over to a service station or disposal depot. Never pollute the water by discarding the oil overboard.

After filling oil start the engine and run it for a few minutes at idling speed. Then check the oil level on the Twin Disc gear with the engine running at idling speed and the gear in "Neutral".

The level in the Borg Warner and SCG reverse gears should be checked immediately after the engine has stopped.

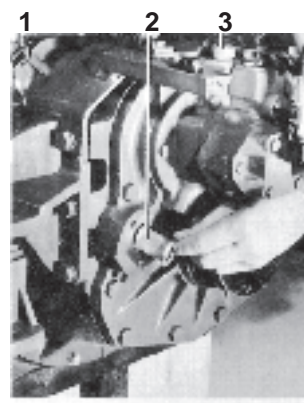
Also check that the oil pressure in the reverse gear is normal and that there are no leakages and that no abnormal sounds can be heard.

See also "Precautions in connection with oil changing", below.

Precautions in connection with oil changing

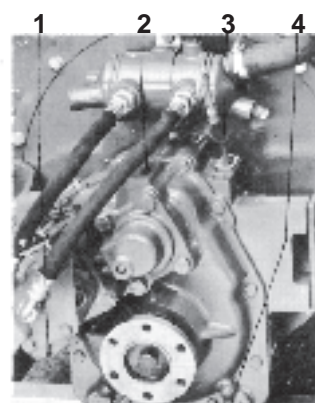
Applies to SCG 350 HDMK3: replacing the filter.

Unscrew the housing, remove the filter and clean the housing by washing in white spirit or fuel oil. Replace the rubber gasket if necessary and fit a new filter.



Twin Disc reverse gear
MG506 (70-engines)

1. Oil dipstick
2. Strainer
3. Filler cap

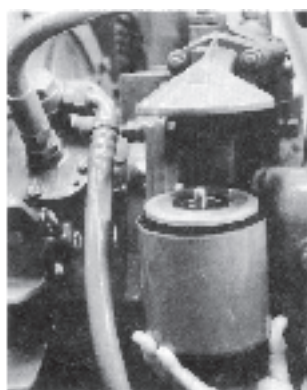


Twin Disc reverse gear
MG502 (60-engines)

1. Plug, remove to clean strainer.
2. Oil filler and breather.
3. Pipe for dipstick. Outer diameter 13 mm.
4. Drain plug.



Removing strainer,
BW reverse gear
(60-engines)



Replacing the filter,
SCG-reverse gear
(70-engines)

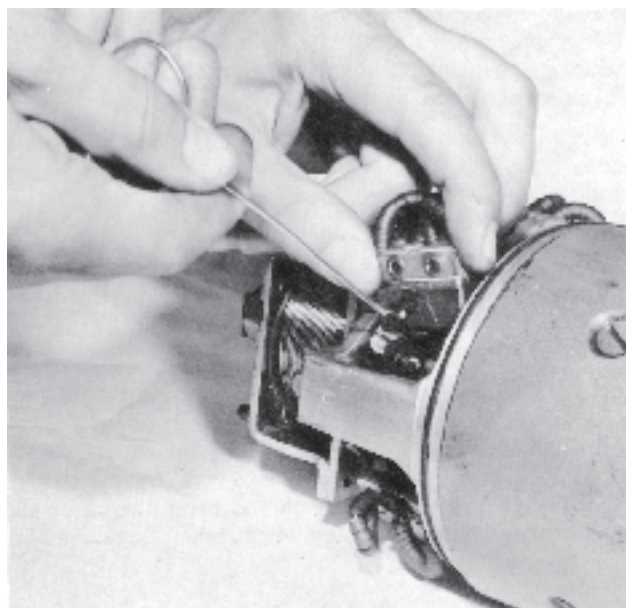
28. Starter motor, alternator and fuses

NOTE! Disconnect both battery cables before carrying out any work on the electrical system.

Starter motor, checking brushes and commutator

This check should be carried out after every **1200 hours** of operation.

Disconnect the starter motor cables and remove the starter motor. Take off the starter motor protective cover. Lift the brush springs and pull out the brushes. These should run easily in their holders. Clean dirty or sticking brushes with a cloth moistened with petrol (gasoline). Replace damaged or worn brushes. If the commutator is scored, oval or burnt, the starter motor should be reconditioned by authorized service personnel. Check the tension of the brush springs by using a spring balance. The spring force should be approx. 12-14N (1.2-1.4 kp = 2.6-3.1 lbf). Replace faulty springs.



Alternator, checking brushes and slip rings.

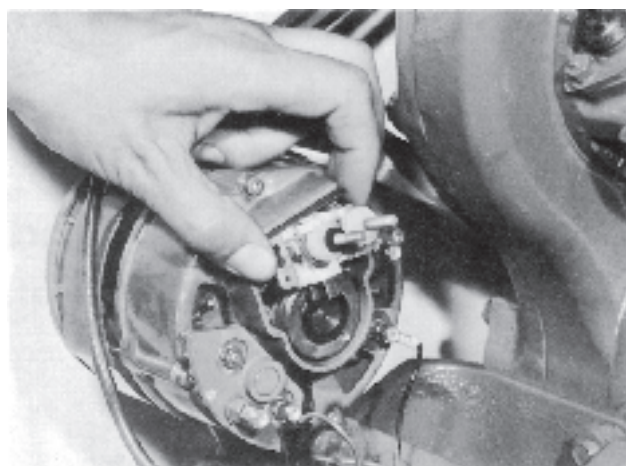
The check should be carried out after every **1200 hours** of operation.

Small alternator

Clean the alternator externally. Unscrew the nuts on both terminals on the alternator end cover (one of the terminals is marked DF).

Remove the cover and unscrew both the brush holder screws. Carefully lift out the brush holder taking care not to damage the brushes.

Check that the brushes run easily in their holders and that at least 5 mm of the brushes project and that the brush cables are not damaged and are well soldered. If necessary, replace the complete brush holder including the brushes. If the slip rings are scored, they should be rectified by authorized service personnel.



Large alternator (1600W. Optional equipment)

Clean the alternator externally. Check that the ventilation holes in the front end are open.

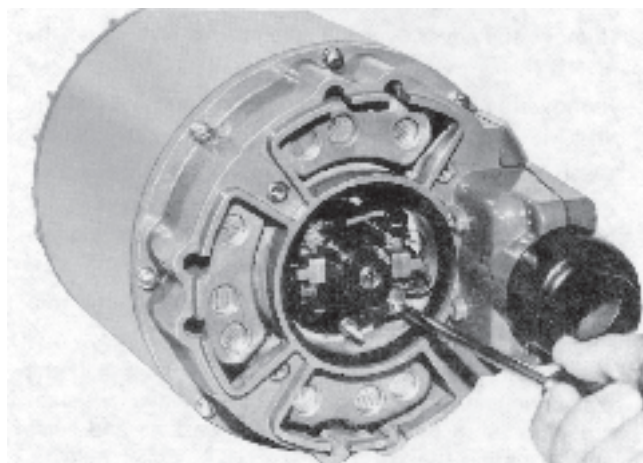
Remove the cover, the casing and the brush cap at the rear end of the alternator. Remove the screws retaining the brush cap and then carefully bend up the cap. Note the rubber gasket.

Check that the length of the brushes is at least 8 mm and that they run easily in their holders. Check that the brush cables are undamaged and well secured.

Check that the brush spring force is 2.3-2.8N (0.23-0.28 kp = 0.5-0.6 lbf).

Also check the slip rings. Scored or corroded slip rings must be rectified by authorized service personnel.

If it is necessary to replace the brushes, loosen the connection screws, lift up the springs and pull out the brushes. Assembly is carried out in reverse order.



Lubrication

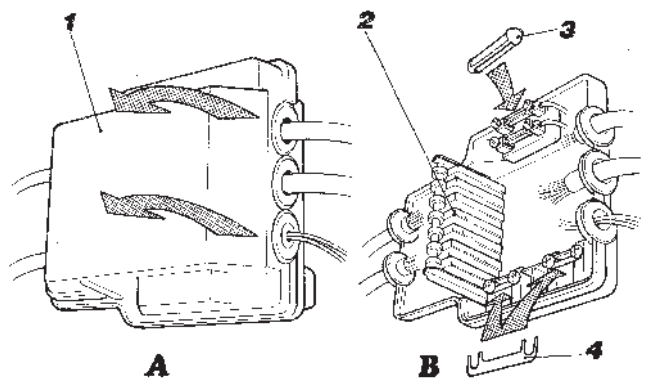
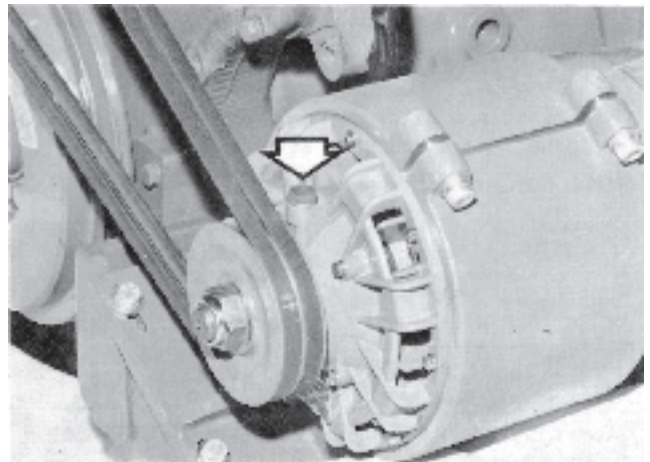
The large alternator should be lubricated after every **1200** hours of operation. (The small alternator is only lubricated in connection with an overhaul.)

Unscrew the plug above the lubricating hole at the bearing, close to the belt pulley. Use a small quantity of Shell Retinax A or equivalent lubricant. Refit the plug.

Fuses

The fuses are positioned in the black plastic box at the side of the engine.

When changing fuses, first bend the cover (1) open in the direction indicated by the arrows in the figure. Replace the damaged fuse with a new one. Make sure that the terminal block (2) is located in its groove and press the cover shut again. Lastly, the cable sealing rings should be pushed into their grooves.



Connecting box with fuses

1. Cover over fuses
2. Terminal block
3. Fuses (25A, engine)
4. Fuses (50A, for standard alternator but 80A for the 1600W alternator)

Every 2400 hours

(Or when necessary.)

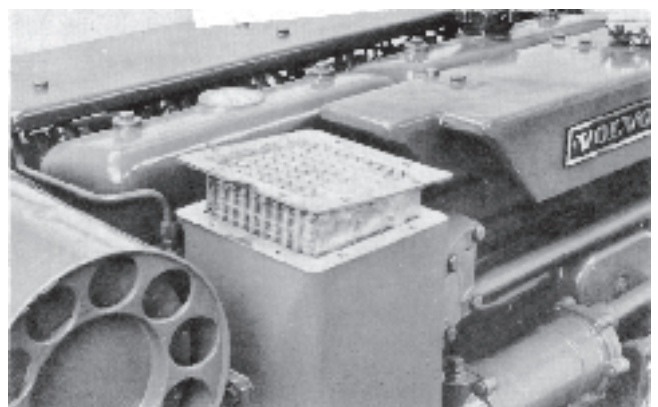
29. Heat exchanger and after-cooler, cleaning

Clean the inserts **once a year** or after every **2400 hours** of operation.

Close the bottom valve and drain the coolant before carrying out any work on the cooling system. After completing work, pump the coolant out of the boat if necessary.

TAMD60

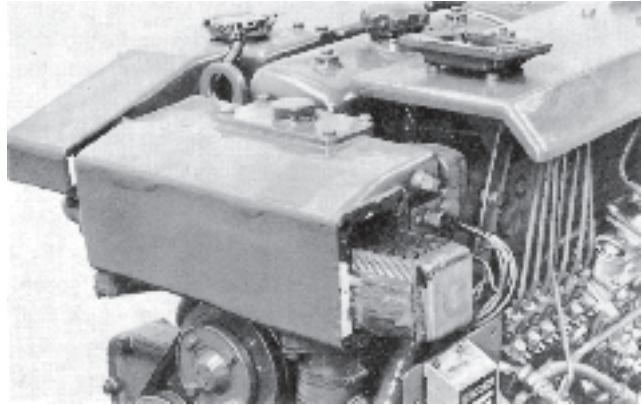
1. Remove the cover over the after-cooler and lift up the insert.
2. Remove the heat exchanger end cover and pull out the insert.
3. Clean the inserts, both inside and out.
4. Clean the heat exchanger housing and the after-cooler housing. Make sure that no impurities enter the engine.
5. Check that the small drain hole (1.5 mm) in the bottom of the after-cooler housing is open.
6. Grease the heat exchanger pipe connections and the connections to the after-cooler with water resistant grease prior to assembly. Use new gaskets and seals and assemble the parts.



After-cooler TAMD60

AQD70, TAMD70

1. Remove the screws securing the cooling water pipe between the heat exchanger end cover and the reverse gear oil cooler.
2. Carefully bend loose the pipe from the end cover.
3. Undo the hose clamp between the after-cooler and the heat exchanger and the clamp on the cooling water line under the after-cooler.
4. Remove the screws securing the end cover at the front of the heat exchanger and the cover over the after-cooler and remove these. Pull out the inserts.
5. Clean the inserts inside and out. Also clean the housings. Make sure that the drain hole (1.5 mm) in the bottom of the after-cooler housing is open. **Make sure that no impurities enter the intake manifold.**
6. Replace all gaskets and sealing rings and re-fit the parts.



Heat exchanger TAMD60

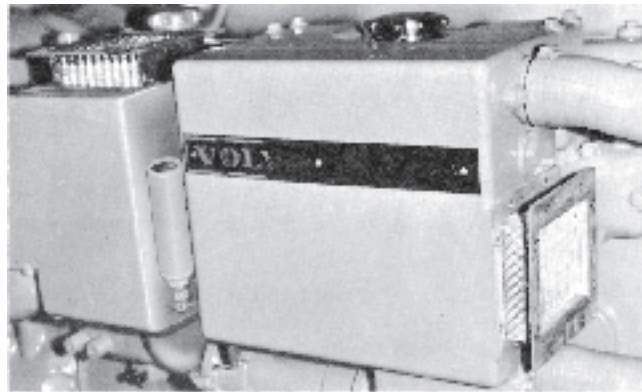
30. Oil cooler, cleaning

Clean the inserts (for engine and reverse gear) **once a year** or after every **2400 hours** of operation. If the oil cooler is to be pressure-tested it should be removed from the engine.

Close the bottom valve and drain the coolant before carrying out any work on the cooling system.

Oil-cooler for TAMD60-engines

1. Remove the front end of the cooler and the pipe between the seawater pump and the cooler.
2. Remove the cover with the oil trap from the block (applies to TAMD60A) and pull out the cooler insert. The insert can only be pulled out forwards because it is provided with a flange at the front end.
3. Wash the insert in white spirit and blow it dry with compressed air. Clean the end sides of the inserts with a wire brush and clean the inside of the tubes with a suitable brush. Clean the housing.
4. Use new gaskets and fit the parts.

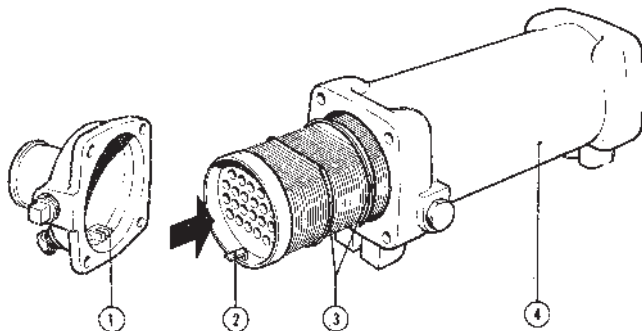


Inserts in after-cooler and heat exchanger, AQD70, TAMD70

Oil cooler for AQD70C, TAMD70C engines

The oil cooler for the AQD70C and TAMD70C engines have an insert which can only be removed and fitted in one way, due to the design of the deflector plates. To ensure correct location of the insert it has a guide on the lower edge of one of its ends which fits into a recess in the end cover.

1. Remove both end covers. Note the position for the guide and then remove the housing from the engine.
2. Push out the insert by pressing on the end with the guide.
3. Wash the insert in white spirit and blow dry with compressed air. Clean the end sides of the insert with a wire brush and clean the inside of the tubes with a suitable brush. Clean the housing.
4. Fit the insert by first pushing in the end which does not have the guide. The insert should fit with its guide in the end cover recess.



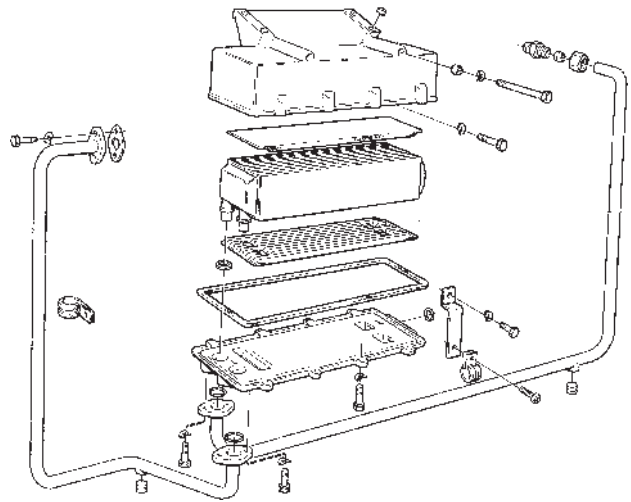
Oil cooler AQD 70 C, TAMD 70 C

1. End cover with recess for guide
2. Guide
3. Deflector plates
4. Housing

5. Use new gaskets and fit the housing to the engine.
6. Fit new sealing rings on the ends and then fit the end covers. The covers for this cooler lie tight against the housing.

Oil cooler for AQD70D, TAMD70D engines

1. Drain the coolant from the fresh water system. Remove the oil cooler coolant pipes.
2. Place a collecting vessel under the oil cooler and loosen the oil distribution housing from the cylinder block. Pull out the connections from the oil cooler cover.
3. Take off the cover and remove the insert. Take care of the flat seals (rubber) at the upper and lower ends of the insert.
4. Wash the insert in white spirit, flush out internally and blow dry using compressed air. Clean the housing.
5. Refit the parts in reverse order. Note that the lower flat seal is equipped with cut outs for the flow of oil. Use new sealing rings. Grease the cooler element pipe connections with water-resistant grease before connecting the coolant pipes.
6. Fill the engine with the coolant.



Oil cooler AQD70D, TAMD70D

Oil coolers for all reverse gears

1. Loosen both the ends of the oil cooler and remove the insert.
2. Wash the insert in white spirit and blow dry using compressed air. Clean the end sides of the insert with a wire brush and clean the inside of the tubes with a suitable brush. Clean the housing.
3. Use new sealing rings when fitting. Do not tighten the screws too hard. Normally there should be a space between the housing and the end covers.

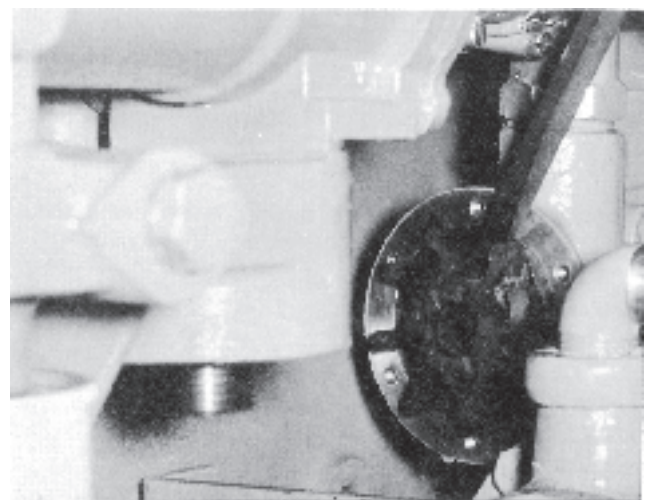
31. Impeller, replacing

The impeller should be changed **once a year** before the beginning of the season.

Close the bottom valve and drain the seawater from the engine.

1. Remove the pump end cover. Prize out the impeller with the help of two screwdrivers.
NOTE. Place some kind of protection under the screwdrivers in order not to damage the housing.
2. Clean the inside of the housing.
3. Press in the new impeller and fit the sealing washers on the outer end of the impeller centre, if this has not already been done. Fit the cover together with a new gasket. Close the cocks and open the bottom valve.

Make sure that there is always a spare impeller and gasket on board.



Impeller, seawater pump

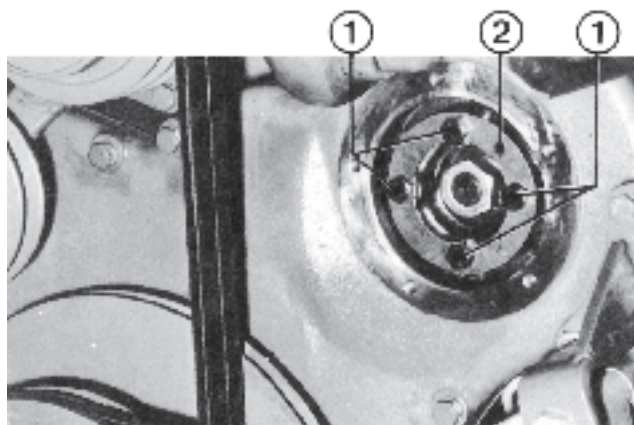
32. Fuel injection pump

NOTE! Any repair work required to be done on the fuel injection pump should be carried out by specially trained mechanics who have the necessary tools and testing devices at their disposal. All warranty on the engine becomes null and void if the seals are broken by unauthorized persons.

Since operating conditions vary considerably, it is difficult to indicate any definite interval, but the pump settings, max. and idle speeds, exhaust smoke, etc. should generally be checked after every **2400 hours** of operation.

Always check and clean the injectors and make sure that the air lines to the turbo do not leak before checking the engine exhaust smoke. The air cleaner should also be cleaned and the air lines must be free from constrictions.

In order to ensure even loading of the cylinders, the fuel injection pump should be checked on a test bench. This is extremely important with regard to engine life. This check is preferably carried out in connection with the laying-up of the boat at the end of the season.



Pump drive TAMD 60

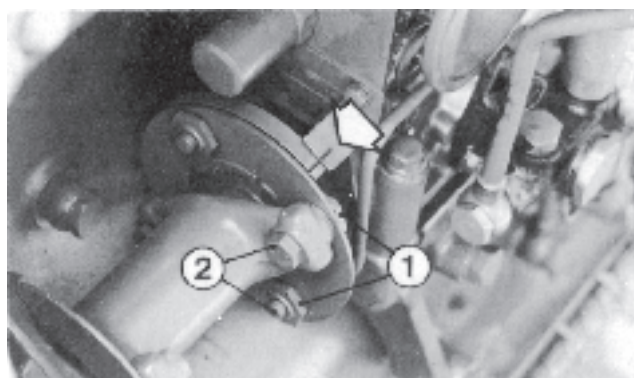
1. Screws in drive flange
2. Lock washer

33. Turbo-compressor

Check the turbo-compressor thoroughly after every **2400 hours** of operation with regard to leakages of the oil lines and air hoses. Check also the bearing clearance and charging pressure as well as the general condition of the unit. This check should be carried out by authorized personnel.

If necessary, replace the turbo-compressor with a new or reconditioned unit.

Always fit new oil filters and change the engine oil when replacing the turbo-compressor. Fill the turbo-compressor bearing housing with 0.1 litre (0.1 quart) of oil before connecting the oil delivery pipe.



Pump coupling (protective cover removed) 70-engines

1. Nuts
2. Coupling screws

34. General checking

It is difficult to indicate a definite time for reconditioning the engine since operating conditions vary considerably. By measuring the compression pressure and observing the consumption of lubricating oil it is, however, possible to estimate roughly when the engine should be dismantled and checked for wear.

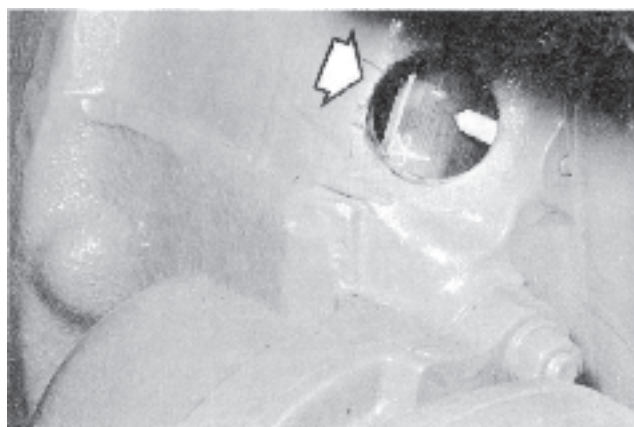
In connection with a major overhaul of the engine, the reverse gear and reduction gear, if fitted, should also be removed and checked for wear.

Cylinder heads and gaskets

Both cylinder heads have separate steel gaskets with special rubber seals for sealing against water and oil.

A used gasket must never be refitted. Always fit a new gasket. The cylinder head bolts should be tightened with a torque wrench and in the correct sequence by personnel from an authorized service workshop.

The valve clearance should always be adjusted after the cylinder heads have been tightened.



Angle graduation marking on flywheel

35. Inhibiting

Corrosion of the engine components must be prevented as otherwise the engine will gradually be destroyed. For this reason, the engine should be protected against such damage by the following measures:

A. If the engine is to remain idle for a period of time not exceeding one month it should be started after 14 days and run warm for about one hour.

If there is risk of frost, the seawater circuit in the cooling system should be drained after stopping the engine. The fresh water system should be filled with a Volvo Penta ethylene glycol mixture. The concentration of glycol used should be able to cope with the lowest temperature likely to occur. Do not use less than 40 % by volume of ethylene glycol. With a low ethylene glycol content there is risk of damage from corrosion. Regarding volumes, see page 13.

The drain plug in the exhaust line condensation water collector, if fitted, should be removed to allow the condensate to run out. Drain any water that may have collected at low points in the exhaust line.

B. If the engine is to remain idle for more than one month, inhibiting is recommended according to the points given in the following text.

If inhibiting is intended only to cover the normal winter lay-up, Volvo Penta engine oil can be used instead of the rust-proofing oil specified in the following text. This will enable the engine to be driven directly at the beginning of the new season. In this case, the oil and oil filter(s) should be changed immediately before laying-up and should not, of course, be drained. The engine should be run warm after the oil change.

Remember to utilize the break in operation to carry out the periodical routine servicing which must, in any case, be carried out.

1. Run the engine warm to its normal operating temperature.
2. Stop the engine and drain or pump out the lubricating oil from the oil sump.
3. Fill the engine with rust-proofing oil to a level between the marks on the dipstick. Suitable rust-proofing oils are Esso Rust-Ban 623 or other manufacturers equivalent oils.

In the case of normal winter lay-up the engine can be filled to the usual level with Volvo Penta lubricating oil instead of rust-proofing oil.

The reverse gear and reduction gear if fitted should be filled to the (upper) mark on the dipstick with the usual recommended lubricating oil.

4. Pump the oil out of the injection pump camshaft housing using a pump. Thereafter, fill the housing with the same type of rust-proofing oil as used in the engine, (approx. 1 litre = 1 quart). This point is omitted if Volvo Penta lubricating oil is used.
5. Disconnect the fuel line to the feed pump and the return line to the tank. Connect the lines, using hoses, to a vessel containing 1/3rd Volvo Penta lubricating oil, Rust-proofing oil of type Esso Rust-Ban 623 or equivalent and 2/3rds diesel fuel.

6. Vent the fuel system and start the engine. See chapter "Running". Let the engine run at rapid idle until about 2 litres (2 quarts) have been consumed from the vessel.
7. Stop the engine and pump out the rust-proofing oil from the oil sump. Connect the ordinary fuel lines.

However, if a change of oil has recently been carried out where Volvo Penta lubricating oil was used, this need not be pumped out.

8. Close the bottom valve and drain the seawater system completely, see under "Precautions in case of frost". The engine fresh water system must either be completely drained or have anti-freeze added, suitable in the form of Volvo Penta ethylene glycol.
9. Remove the batteries from the boat and take them to a charging station for periodical charging in accordance with the manufacturers instructions.
10. Protect all external unpainted surfaces with suitable preservative fluid. The surfaces should be clean and dry before the fluid is applied.

NOTE! Certain preservative fluids intended for outside use are inflammable and should, therefore, be used with care. Furthermore, some fluids are dangerous to inhale, a breathing mask should therefore be worn when such fluid is being sprayed on.

11. From this point on, the engine must not be turned over again until it is to be taken into use. Mark the engine clearly with some kind of notice saying that the engine has been inhibited and give the date. Also state that the seawater has been drained and whether the fresh water system has been drained or glycol been added and state the freezing point of this protection. Also make a note of whether the oil has been drained or a change of Volvo Penta lubricating oil has been carried out.
12. Cover the engine if necessary as protection against dirt.

36. De-inhibiting

1. Remove any covers on the engine.
2. Wash off the preservative fluid on the outside with white spirit.
3. Provided the coolant was drained, close the drain cocks and fill the fresh water system with water mixed with Volvo Penta glycol. See under "Running". Open the bottom valve.
4. Fill the engine, if necessary, with the correct quality of lubricating oil and check the level in the reverse gear and reduction gear if fitted. Fit new oil filters, if they were not changed in connection with the changing to Volvo Penta lubricating oil when laying-up the boat.
5. Connect the batteries.
6. Fit new fuel filters, vent the fuel system and start the engine. See under "Running". Run the engine warm at rapid idle before running under load.
7. Check for oil, fuel or cooling water leakage.

Technical Data

Engine

Type designation	TAMD60A TAMD60B	AQD70C TAMD70C	AQD70D TAMD70D
Number of cylinders	6		6
Cylinder bore mm	98.4		104.77
Stroke mm	120		130
Displacement dm ³ (litre)	5,48		6.73
Idling speed r/s (r/min)	10.9 (650)		9.2 (550)
Compression pressure at starter motor speed MPa (kp/cm ² , p.s.i.)	2.5/3.8 r/s (25,356/230 r/min)		2.35/3.0 r/s (24,341/180 r/min)
Firing order (No. 6 cylinder nearest flywheel)	1-5-3-6-2-4		1-5-3-6-2-4
Direction of rotation seen from front end of engine	Clockwise		Clockwise
Cylinder liners, type	Wet, replaceable		Wet, replaceable
Valve system	Overhead		Overhead
Valve clearance, engine not running, (cold or operating temperature) Inlet mm	0.40		0.40
Outlet mm	0.45		0.55
Inboard engines Inclination when running, max. degrees	20		18
Weight of engine without reverse gear AQ-version kg	—	840	850
(lb)	—	(1852)	(1874)
Inboard version kg	670	810	820
(lb)	(1477)	(1786)	(1808)
Lubricating system			
Oil quality according to API system		CD (For Service DS)	
Viscosity above +20°C (68°F)		SAE 30 Alt. 20W/30	
between +20°C and -10°C (68°F and 14°F)		SAE 20/20 W	
below -10°C (14°F)		SAE 10W or 10W/20	
all temperatures		SAE 15W/40	
Oil capacity			
AQ-version and inboard version without inclination dm ³ (Imp.gall.-USgall)	20 (4.4-5.3)		27 (6-7)
Inboard version (inclination 18°) dm ³ (Imp.gall.-USgall)	13 (2.9-3.4)		16 (3.5-4.2)
Oil pressure warm engine at operating speed MPa (kp/cm ² , p.s.i.)		0.3-0.5 (3-5, 43-71)	

Cooling system

Capacity incl. heat exchanger	dm ³ (Imp.gall.-USgall.)	20 (4.4-5.3)	28 (6.2-7.4)	30 (6.6-7.9)
		23 (5-6)*		
Thermostats begin to open at	°C(°F)	68-72 (154-162)		74-78 (165-172)
		74-78 (165-172)**		
fully open at	°C(°F)	78-82 (172-180)		84-88 (183-190)
		84-88 (183-190)**		

* With a separate expansion tank

** The thermostats on the 60-series engines open at different temperatures

Hydraulic system

AQD70C, AQD70D and otherwise as optional equipment

Oil quality and viscosity	Same as in engine
Oil capacity dm ³ (Imp. gall-US gall.)	7 (1.5-1.9)

Fuel system

	TAMD60A	AQD70C, TAMD70C
Fuel injection pump Bosch	PES6MW 100/320	PE6P 110 A 320RS 260Z
	RS5Z	PE6P 110A 320RS 260Y*
Injectors (holders) Bosch	KBAL 112S 28/4	KBAL 112S 28/4**
Nozzles Bosch	DLLA 150S 204	DLLA 150S 634 (early prod.)
		DLLA 150S 582 (late prod.)
Hole diameter (4 holes) mm	0.32	0.40
Opening pressure MPa (kp/cm ² , p.s.i.)	19.6 (200, 2845)	19.1 (195, 2775) early prod.
		18.6 (190, 2700) late prod.
Injectors (holders) Bosch (without rod filter)***		KBL 112S 82/13*
Nozzles Bosch		DLLA 150S 138*
Hole diameter (4 holes) mm		0.355*
Opening pressure MPa (kp/cm ² , p.s.i.)		19.6 (200, 2845)*
Centrifugal governor, Bosch	RWV 300-1400 MW4	EP/RSV250-1250
		PO/374/2R
Feed pump operating pressure kPa (kp/cm ² , p.s.i.)	100-150 (1.0-1.5, 14-21)	100-150 (1.0-1.5, 14-21)
Fuel injection pump, setting B.T.D.C.	22°	22°
* TAMD70C set for 176 kW (240 hp), from and including engine No. 55286/xxxx and engines set for 152 kW (206 hp) output and for the Japanese market from and including engine No. 55094/xxxx. ** Without rod filter on AQD70C, TAMD70C from and including engine No. 55144/xxxx. *** With rod filter on TAMD70C for the Japanese market, early prod.		
Fuel injection pump Bosch		
Injectors (holders) Bosch		
Nozzles Bosch		
Hole diameter mm		
Opening pressure MPa (kp/cm ² , p.s.i.)		
Centrifugal governor Bosch		
Fuel feed pump, working pressure kPa (kp/cm ² , p.s.i.)		
Injection pump, setting B.T.D.C.		

TAMD60B

PES6MW 100/320
RS1004Z
KBEL 95 P 9/4
DLLA 150 P 28
4 x 0.34
24 (245,3485)
RSV 250-1400
MW2/308
100-150 (1.0-1.5, 14-21)
22°

AQD70D, TAMD70D

PE6P 110A 320
RS260Z
KBEL 95 P 9/4
DLLA 150 P 32
3 x 0.46
27 (275,3911)
EP/RSV 250-1250
PO/374/2R
140-160 (1.4-1.6, 20-22)
20°

Electrical system

	TAMD60	AQD70, TAMD70
Voltage of electrical system V	12 (alt. 24)	24 (alt. 12)
Alternator,		
output (SEV Marchal, std) W	500 (650)	650 (500)
alt. (CAV optional equipment) W	1600	1600
Starter motor output kW (hp)	3 (4)	3 (4)
Battery capacity, 24V system voltage,		
Engine with starter motor type KG (R)	2 batteries connected in series 12V/152 Ah, (Max 180Ah)	
Engine with starter motor type KB	2 batteries connected in series 12V, max. 110 Ah*	
Battery capacity, 12V system voltage,		
Engines with starter motor type KG (R)	2 or 3 batteries connected in parallel 12V/70 Ah, (total max. 210 Ah)	
Engines with starter motor type KB	2 batteries connected in parallel 12V, max 110 Ah*, (total max. 220 Ah*)	
Density of electrolyte at +20°C (68°F)		
fully charged battery g/cm ³	1.275-1.285	
recharge at g/cm ³	1.230	

* According to DIN 72311

Turbo-compressor

Manufacturer, type (TAMD60A-AQD70C, TAMD70C)

(TAMD60B-AQD70D, TAMD70D)

Lubrication

Cooling

TAMD60

Holset 3LD-530A/
2.5 WSO
KKK-K27-2970 N/14.7

AQD70, TAMD70

Holset 3LD-530A/
2.5 WSO
KKK-K27-3068/14.7

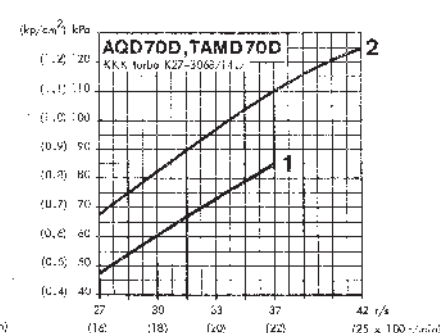
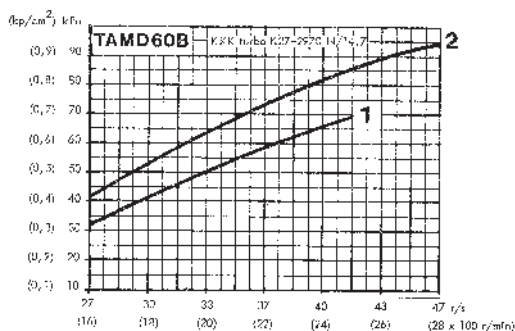
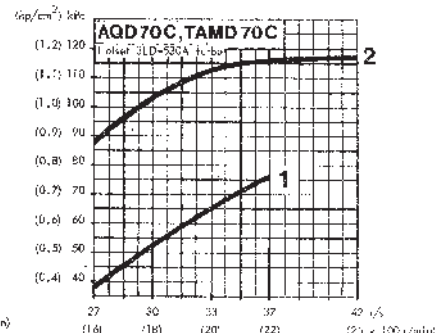
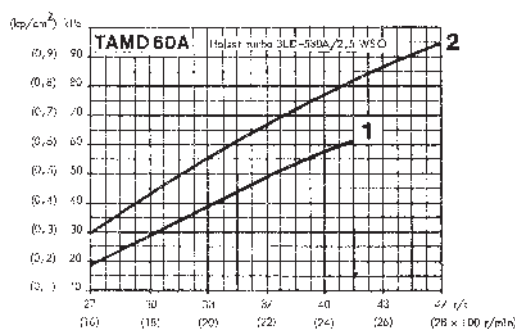
From engine lubricating system

From engine fresh water cooling system

Charging pressure

Charging pressure at 100% engine load and an ambient air temperature of approx. +20°C (68°F). Curve 2 applies to pleasure boats (output according to curve B) and curve 1 for other installations (output according to curve C).

A considerably lower charging pressure is obtained if the engine is not running at full output.



Reverse gear

Twin Disc model

Ratios

Oil quality and viscosity

Oil capacity (including cooler) dm³ (imp.gall-US.gall)

Working pressure at oil temperature 82°C (180°F)
(engaged 30r/s-1800 r/min) MPa (kp/cm², p.s.i.)

at cruising speed, min MPa (kp/cm², p.s.i.)

Weight kg (lb)

TAMD60

MG502
1.5:1, 2:1, 2.5:1
2.5 (0.6-0.7)
2.2-2.4 (21.8-24.0,
310-340)
1.93 (19.3, 275)
80 (176)

AQD70, TAMD70

MG506
1:1, 1.5:1, 2:1, 3:1
Same as in engine
6.5 (1.4-1.7)
2.1-2.2 (21-22.5,
300-320)*
1.9 (19.0, 270)
100 (220)

* 2.5 (25.3,360) for engines with 199 kW (270 hp) propeller shaft output.

SCG, model

Ratios

Oil quality and viscosity

Oil capacity (incl. cooler) dm³ (Imp.gall. USgalls)

Oil pressure, normal when running MPa (kp/cm², p.s.i.)

Weight, (rotation same as engine) kg (lbs)
(rotation opposite to engine) kg (lbs)

MRF 350 HDMK3B

1.5:1, 2:1, 3:1
Same as in engine
12.5 (2.8, 3.3)
0.85 (8.5, 121)
175 (386)
170 (375)

	TAMD60	AQD70, TAMD70
Borg Warner, model	73 CR	V-drive 10-05
Ratios	2:1, 3:1	1.5:1, 2:1
Oil quality	Same as in engine (viscosity, however SAE 30)	
Oil capacity (including cooler) dm ³ (Imp.gall,US gall.)	2.5 (0.6-0.7)	5.5 (1.2-1.5)
Oil pressure, normal during running MPa (kp/cm ² , p.s.i.)	0.85-1 (8.5-10, 120-140)	0.77-1.05 (7.7-10.5, 110-150)
Weight kg (lb)	85 (187)	120 (265)

Clutch – Reduction gear

Permitted engine speed with engaged power

take-off r/s (r/min) 15.0-30.0 (900-1800)

Twin Disc

Reduction 3.6:1
Size mm (in) 203 (8")
Weight, approx kg (lb) 75 (165)
Oil quality and viscosity Engine oil SAE 40 alt Hypoid
oil SAE 80
Oil capacity dm³ (Imp.qts, USqts) 1 (0.9-1.1)

Borg Warner/Rockford

Reduction 1:1; 2.8:1
Size (1.1; 2.8:1) mm (in) 203 (8") alt 254 (10")
Weight, approx (1:1) kg (lb) 65 (143)
(2.8:1) kg (lb) 75 (165)
Oil quality and viscosity (red. gear) Engine oil SAE 30
Oil capacity, approx (red. gear 8") dm³ (imp.qts,USqts) 1 (0.9-1.1)
(red. gear 10") dm³ (imp.qts,USqts) 1.5 (1.3-1.6)

Wiring diagram

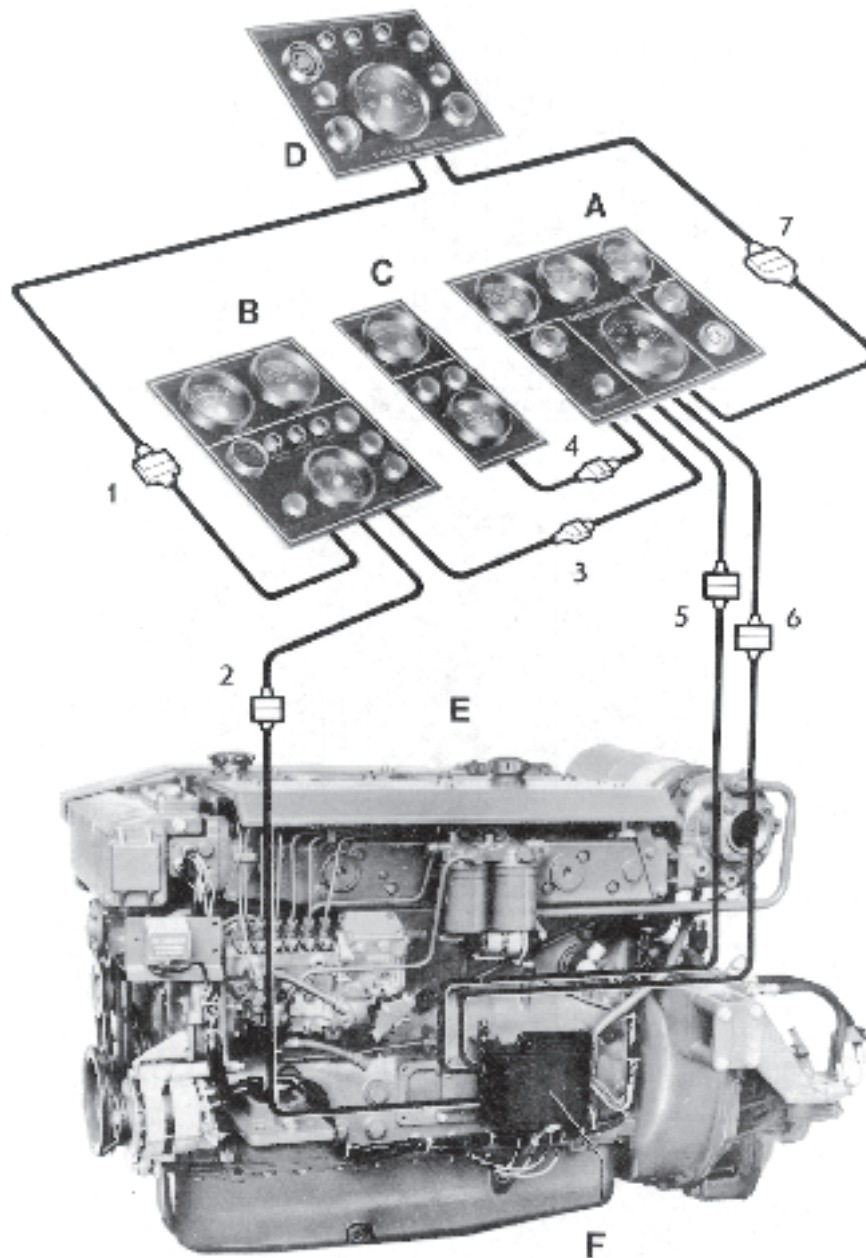


Fig. K1. Block diagram (same for all engines in this book)

- A. Basic instrument panel
- B. Panel with supplementary instruments (alarm, etc)
- C. Panel with fuel gauge and rudder indicator
- D. Flying Bridge instrument panel
- E. Engine
- F. Connection box with fuses

- 1. Contact (male and female) Red, 8-pole
- 2. Contact (male and female) Red, 8-pole
- 3. Contact (male and female) Black, 4-pole
- 4. Contact (male and female) Black, 4-pole
- 5. Contact (male and female) Black, 8-pole
- 6. Contact (male and female) Black, 8-pole
- 7. Contact (male and female) Green, 8-pole

Male and female contacts belonging together have the same colour.

If panel D is fitted but not B, contact No. 1 from the Flying Bridge instrument panel is wired to contact No. 2 from the engine. However, contacts Nos. 1 and 7 should not be wired together when panel D is not fitted.

When only the basic instrument panel A is fitted, contacts 5 and 6 only are wired together.

Contacts left over **should not** be wired together but should be insulated and hung up and protected individually. Cables should not be cut.

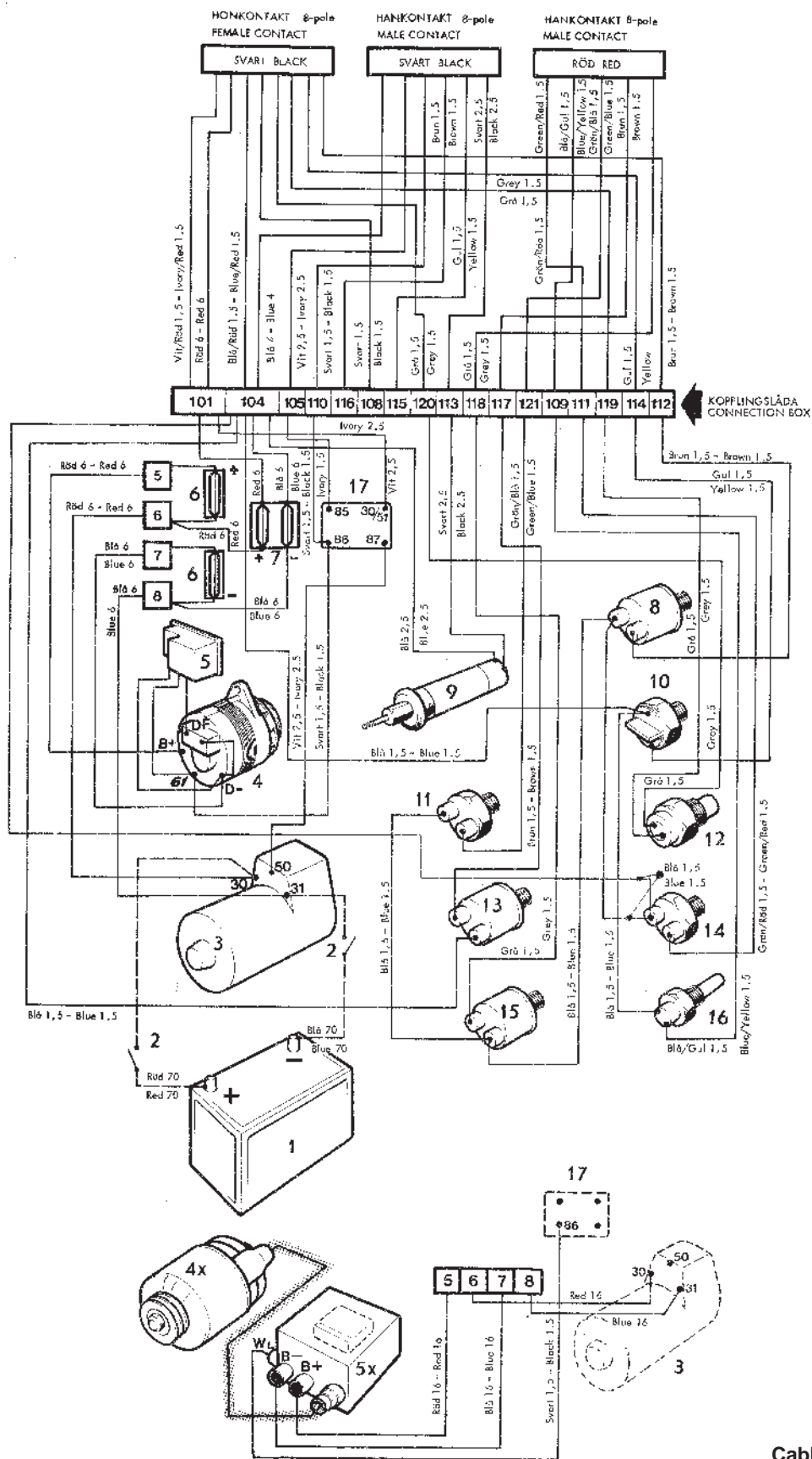


Fig. K2A. Wiring diagram. Engine TAMD60A*, TAMD60B

1. Batteries. Capacity see "Technical data"
2. Master switch
3. Starter motor
4. Alternator
- 4x. Alternator (1600 W, optional equipm.)
5. Voltage regulator
- 5x. Voltage regulator (optional equipm.)
Must not be fitted to engine.
6. Fuses 50 A for standard alternator (80 A for 1600 W alternator)
7. Fuses 25 A (in both cases)
8. Oil pressure sender, engine
9. Stop solenoid
10. Engine coolant temperature sender
11. Oil pressure sensor (for hour meter)
12. Speed sender
13. Oil pressure sender - reverse gear
14. Oil pressure sensor
15. Pressure sender - turbo
16. Engine coolant temperature sensor
17. Starter cut-out relay (only TAMD60B)

* TAMD60A engines

The cable from terminal 105 connects to the starter motor terminal 50 and the cable from terminal 110 connects directly to the alternator terminal 61.

If the large alternator is used (1600W) a cable connects from the voltage regulator terminal WL to terminal 110.

Relation mm²/AWG

mm ²	0.75	1.5	2.5	4	6	10	16	70
AWG	19	15 (16)	13	11	9 (10)	7	5	00

Cable areas are indicated in mm² for all wiring diagrams. The corresponding sizes in AWG can be seen from the table.

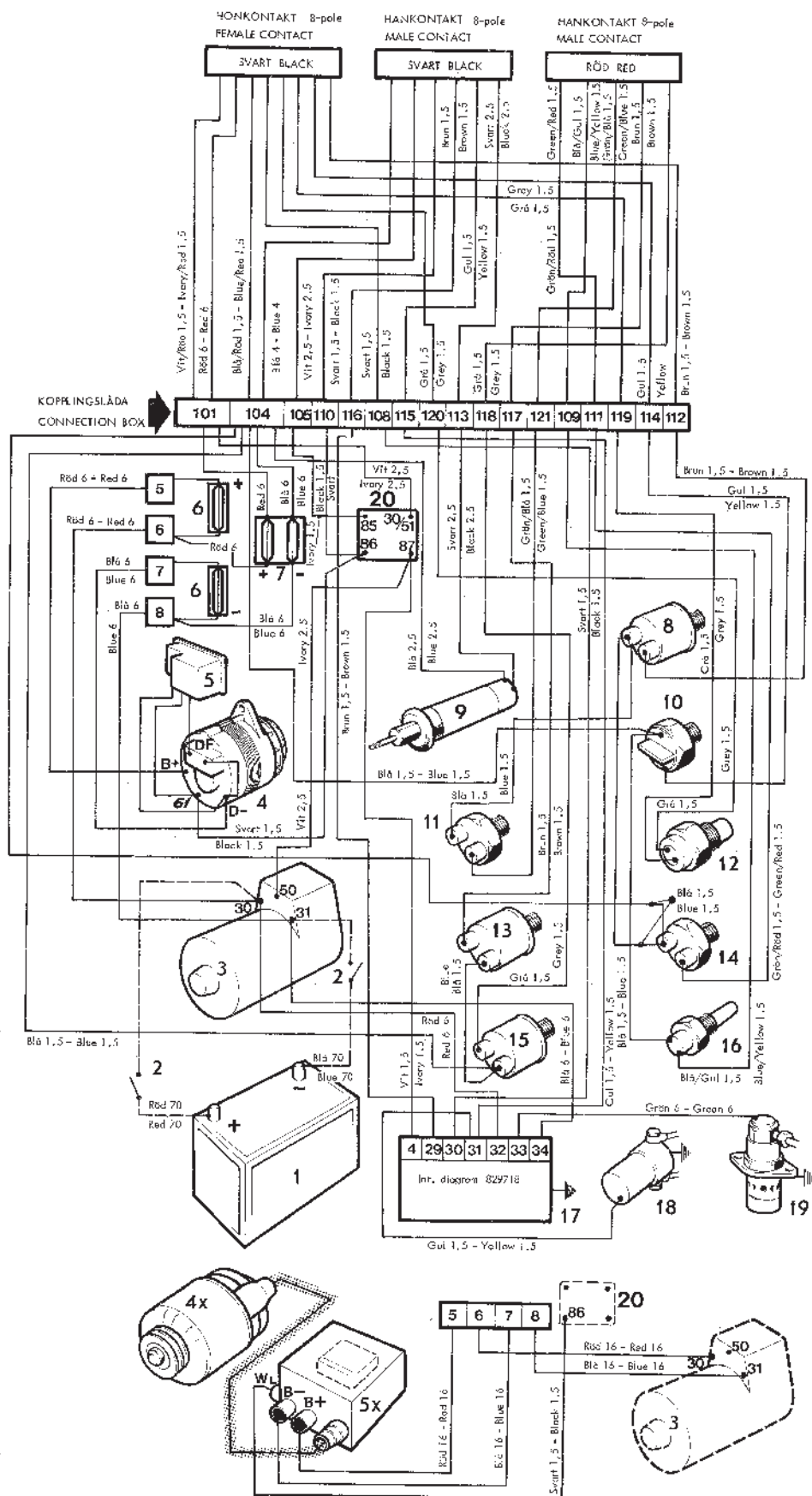


Fig. K2B. Wiring diagram
TAMD70C*, TAMD70D, AQD70C*,
AQD70D

1. Batteries. For capacity see 'Tech. data'.
2. Master switch
3. Starter motor
4. Alternator
- 4x. Alternator (1600 W, optional equipm.)
5. Voltage regulator
- 5x. Voltage regulator (optional equipm.)
Must not be fitted to engine.
6. Fuses 50 A for standard alternator
(80 A for 1600 W alternator)
7. Fuses 25 A (in both cases)
8. Oil pressure sender, engine
9. Stop solenoid
10. Engine coolant temperature sender
11. Oil pressure sensor (for hour meter)
12. Speed sender
13. Oil pressure sender -- reverse gear
14. Oil pressure sensor
15. Pressure sender, turbo
16. Engine coolant temperature sensor
17. Relay box for air pre-heater
18. Solenoid valve
19. Flame glow plug
20. Starter cut-out relay (only
TAMD70D, AQD70D)

***TAMD70C, AQD70C engines:**

Cables from terminal 105 connect to the starter motor terminal 50 and to the relay box terminal 4. The cable from terminal 110 goes directly to the alternator terminal 61.

If the large alternator is used (1600 W) a cable connects directly from the voltage regulator terminal WL to terminal 110.

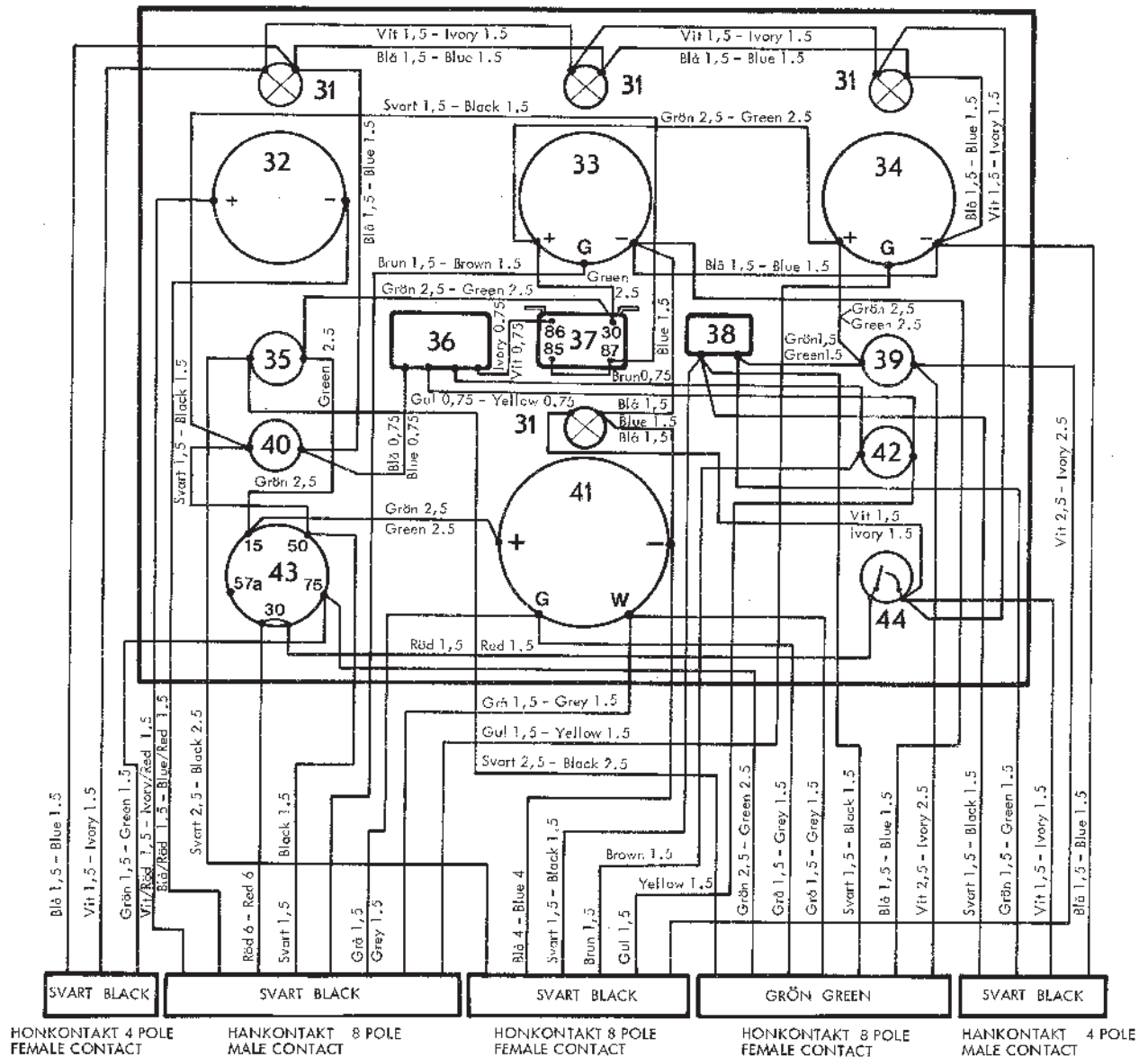


Fig. K3. Wiring diagram. Instruments, basic instrument panel

- 31. Instrument lighting
- 32. Voltmeter
- 33. Oil pressure gauge
- 34. Engine coolant temperature gauge
- 35. Stop button
- 36. Time relay (not on TAM60)
- 37. Holding current relay (Omitted on TAM60 but green cable 2.5 from 35 is connected to + on 33)
- 38. Series resistance
- 39. Starter button
- 40. Indicating lamp (pre-heater, not on TAM60)
- 41. Rev counter
- 42. Indicating lamp (start engine, not on TAM60)
- 43. Key switch
- 44. Rheostat for instrument lighting. (Switch on earlier models.)

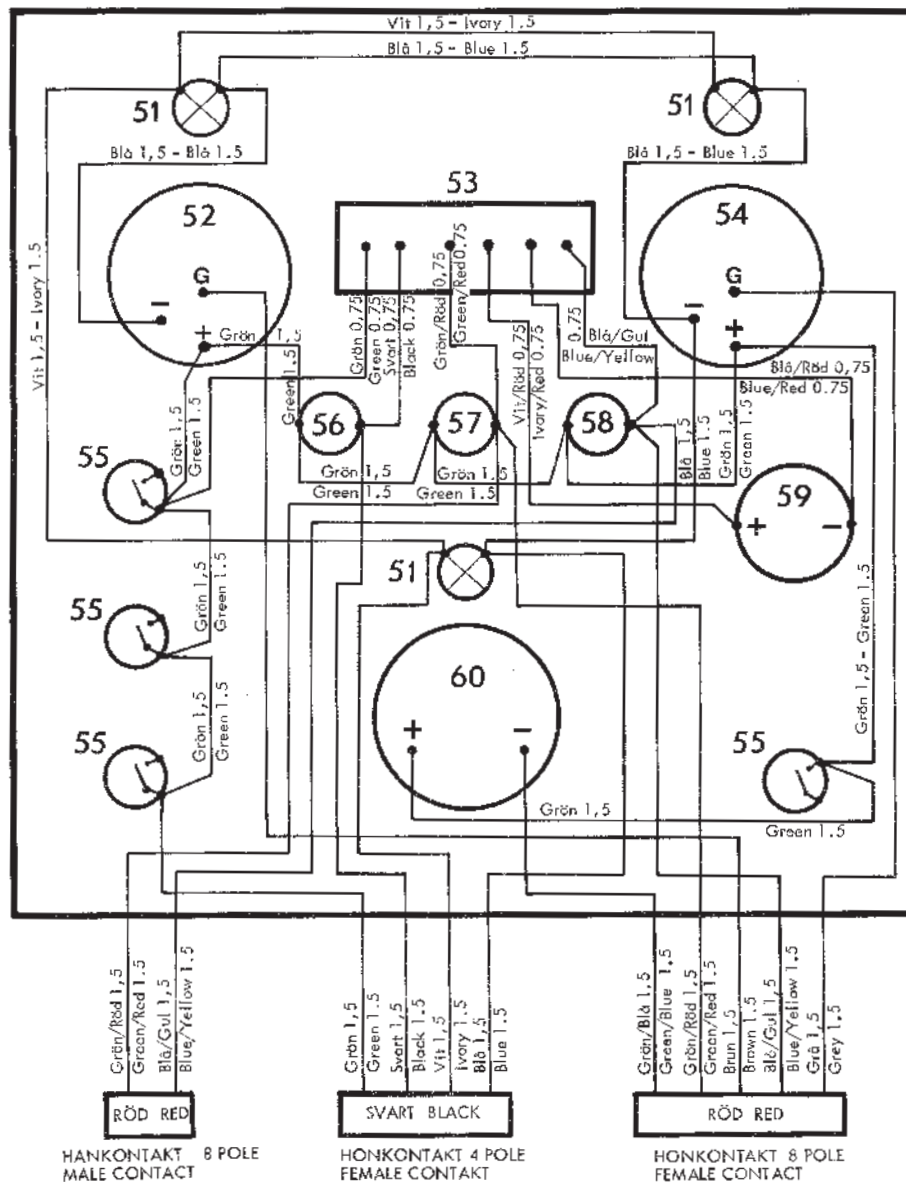


Fig. K4. Wiring diagram. Panel with supplementary instruments (alarm, etc)

- 51. Instrument lighting
- 52. Oil pressure gauge – reverse gear
- 53. Alarm separator
- 54. Pressure gauge – turbo
- 55. Extra switches (max. 5 A per switch)
- 56. Charging warning lamp
- 57. Oil pressure warning lamp – engine
- 58. Engine coolant temperature warning lamp
- 59. Siren
- 60. Hour meter

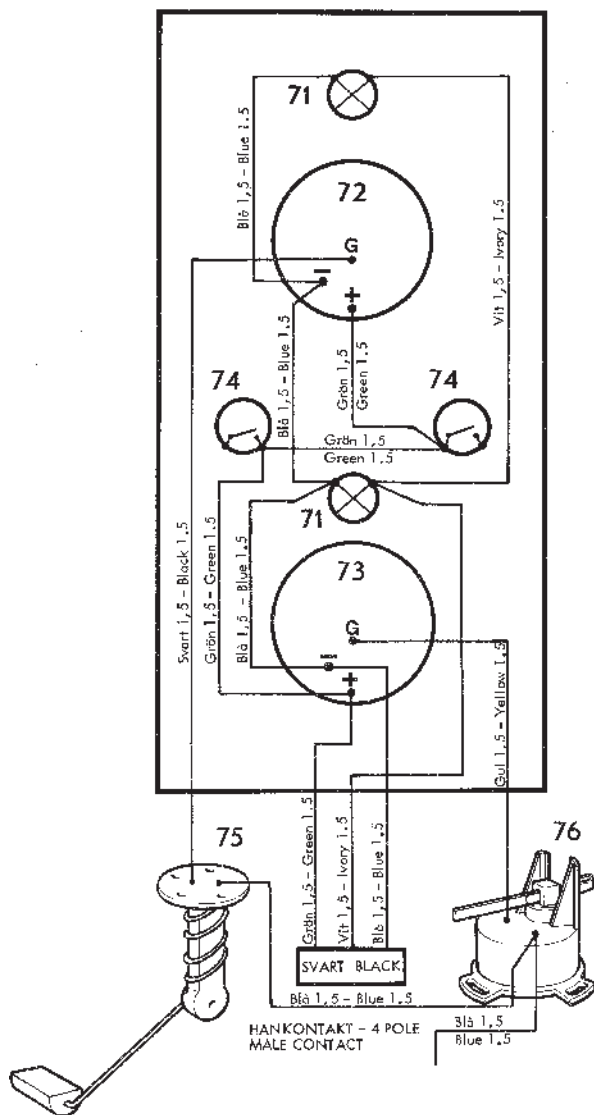


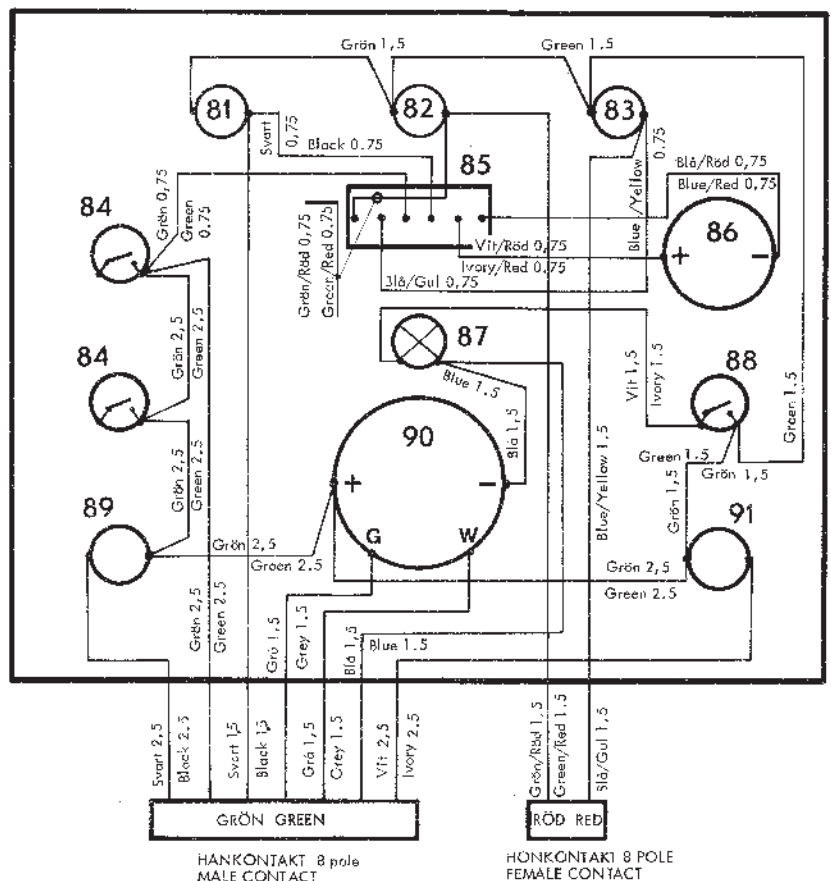
Fig. K5. Wiring diagram. Panel with fuel gauge and rudder indicator.

- 71. Instrument lighting
 - 72. Fuel gauge
 - 73. Rudder indicator
 - 74. Extra switches (max. 5 A per switch)
 - 75. Sender, fuel gauge
 - 76. Sender, rudder indicator
- (The free, blue 1.5 cable should be connected to 104 on the engine terminal box)

Fig. K6. Wiring diagram

Flying Bridge instrument panel

- 81. Battery charging warning lamp
- 82. Oil pressure warning lamp – engine
- 83. Coolant temperature warning lamp
- 84. Extra switches (max. 5 A per switch)
- 85. Alarm separator
- 86. Siren
- 87. Instrument lighting
- 88. Switch, instrument lighting
- 89. Stop button
- 90. Rev counter
- 91. Starter button



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SI unit system

Units according to the international SI system have been used in this book. The earlier units are given after the SI units.

Power is given in kW (kilowatt)
earlier unit hp (horse-power)

Speed is given in r/s (revolutions per second)
earlier unit r/min (revolutions per minute)

Torque is given in Nm (newton metre)
earlier unit kpm (kilopond metre)
earlier unit lbf.ft (poundfoot)

Volume is given in dm³ (cubic decimetre)
earlier unit l (litre)
earlier unit Imp.gall (British Imperial gallon)
earlier unit USgall. (United States gallon)

Pressure is given in Pa (Pascal)
earlier unit kp/cm² (kiloponds per square centimetre)
earlier unit p.s.i. (lbf/in²) (pounds per square inch)

Personal Information:

Name

Address

Tel.

Nearest Volvo Penta Dealer/Service Workshop

Name

Address

Tel.

Information-Engine:

Type of engine

Serial Number

Type of reverse gear/No.

Ratio

Direction of rotation

Clutch with disengaging device, type/No.

Ratio

Direction of rotation

We reserve the right to carry out modifications without previous notice and for this reason the content in this book is not binding.

AB VOLVO PENTA

